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DEPARTMENT OF DEFENSE TEST PROCEDURES

HEARING

BEFORE THE

RESEARCH AND DEVELOPMENT SUBCOMMITTEE

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES
NINETY-NINTH CONGRESS
SECOND SESSION

JANUARY 28, 1986

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CONTENTS

Page

Battista, Anthony, professional staff member, House Committee on Armed Services 2, 27

Bennett, Hon. Charles E., a Representative from Florida 2

Burton, Col. James G., USAF, Military Staff Assistant, Defense Test and Evaluation, Office of the Secretary of Defense—Joint Live-Fire Program:

  Statement 52

  Prepared statement 62

Hollingsworth, Gen. James, USA (Ret.) 43

Price, Hon. Melvin, a Representative from Illinois, chairman, Research and Development Subcommittee 1

Thurman, Gen. Maxwell, Vice Chief of Staff, U.S. Army 79

DEPARTMENT OF DEFENSE TEST PROCEDURES

House of Representatives,
Committee on Armed Services,
Research and Development Subcommittee,
Washington, DC, Tuesday, January 28, 1986.

The subcommittee met, pursuant to call, at 2 p.m., in room 2118, Rayburn House Office Building, Hon. Melvin Price (chairman of the subcommittee) presiding.

OPENING STATMENT OF HON. MELVIN PRICE, A REPRESENTATIVE FROM ILLINOIS, CHAIRMAN, RESEARCH AND DEVELOPMENT SUBCOMMITTEE

Mr. **Price**. The subcommittee will be in order.

This afternoon the subcommittee will discuss the test policy and procedures used by the Department of Defense during the development of weapons systems.

The subject of weapons systems testing is receiving a lot of attention by the Congress and by the media. The central issue is over the adequacy of Department of Defense test procedures. It appears as though more and more weapons systems are somehow making it into production without adequate testing.

This afternoon we will focus on the staff perspective of weapons systems testing using the Bradley Fighting Vehicle as an example. Following the staff presentation, we will hear from Lt. Gen. James Hollingsworth, retired, U.S. Army, who will offer his views on the concept of armor and the infantry support required by tanks, as well as other aspects of conventional warfare requirements.

Following General Hollingsworth, we will hear from Col. James G. Burton, U.S. Air Force, who is presently assigned to the office of the Under Secretary of Defense for Research and Engineering. Colonel Burton will discuss the concept of the Joint Live Fire Test [JLFT] Program.

The subcommittee will conclude with a discussion of the requirements for Mechanized Infantry with Gen. Maxwell Thurman, Vice Chief of Staff, U.S. Army.

I would like to emphasize that this is not a hearing to evaluate the Bradley test results or decide the fate of this vehicle. The Procurement Subcommittee has jurisdiction for the Bradley. Contrary to reports, we are focusing today on testing. We have always worked in concert with the Procurement Subcommittee and this applies to the Bradley. The Procurement Subcommittee will hold a very extensive hearing on the Bradley on February 18. The staff will provide the agenda for this meeting.

STATEMENT OF HON. CHARLES E. BENNETT, A REPRESENTATIVE FROM FLORIDA

Mr. **Bennett**. Mr. Chairman, as a former infantry combat soldier, I am naturally particularly concerned about our combat soldiers. I want to see that whatever arms or equipment our troops have are the best we can get for the success of their missions.

Congress relies heavily on test results to inform our decisions on the development and procurement of new weapons. We must be absolutely sure that real shooting tests of our weapons are conducted objectively, and are reported honestly and without prejudice to the services, to the Secretary of Defense and to Congress.

The Department of Defense's new Joint Life Fire Test Program is a commendable step forward in this crucial area of testing. If done right, I am convinced it can save the lives of thousands of American soldiers. The most important task of this hearing is to make sure that indeed this vital kind of testing is being done right—and to strengthen live fire testing wherever possible.

Today we have a chance to discuss these issues with some very well qualified witnesses. In this discussion I hope we can be assured we have the best equipment for the necessary tactical operations. We should try to improve both equipment and tactics if possible, even if we need some changes.

We have the opportunity to evalute these questions today only because the Army has undertaken a realistic live-fire testing program. Without these tests we would have been locked in sterile debate without any hard evidence. The Department of Defense should be congratulated for this program and I hope this is just the beginning of this kind of testing.

I am grateful that this committee is having this hearing to push the Department of Defense to step up its programs of live-fire testing of both weapons and equipment. What needs to be done, I think, is to assure that such testing in the future is done earlier—in the research and development stage.

That is the end of my statement.

Mr. **Price**. Tony, you may proceed.

STATEMENT OF ANTHONY BATTISTA, PROFESSIONAL STAFF MEMBER, SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT, COMMITTEE ON ARMED SERVICES

Mr. **Battista**. Thank you very much, Mr. Chairman. I have a prepared statement. It is rather lengthy, and I would ask your permission to insert it in the record and summarize. I am accompanied today by General Hollingsworth. General Hollingsworth has been known to this subcommittee for a number of years. He appeared here about 3 years ago before a joint hearing of the Procurement and Research and Development Subcommittee, and offered his views, Mr. Bennett, in an area that you are particularly interested in, ways of improving our conventional fighting capability.

Mr. Chairman, members of the subcommittee, my statement is a bit strong. I didn't intend it to be that way, but in the 13 years that I have been employed by this committee, you have always insisted on complete candor. You have always gotten that from the staff, so my statement reflects the situation as I see it.

If you recall, on December 5 you asked me to appear before the subcommittee and offer my views on ways to improve our defense return on investment. I gave you some rather straightforward candid views at that time. I explained that I really didn't mean to embarrass anyone in the Pentagon, any particular individual, the Department of Defense or any of the services. I offered a statement that was intended as constructive criticism. I personally don't want us to be militarily second to anyone, so consequently I am offering my views on how we might do things better.

If you recall from that December 5 hearing, I ran through a brief chronology of weapons system development, and contrasted that with the development process in the Soviet Union. I had indicated that the U.S. approach toward developing systems was rather revolutionary.

U.S. MILITARY TECHNOLOGY

- A DYNAMIC DIVERSIFIED APPROACH—REVOLUTIONARY
- OFTEN DELAYS THE DEPLOYMENT OF MILITARY HARDWARE
- IS PERFORMED BY COMPETENT, RECOGNIZED ENGINEERS AND SCIENTISTS
- INADEQUATE RESPONSE TO NEAR TERM PROBLEMS OR REQUIREMENTS

We took a very dynamic approach that often deployed the development of military hardware, and that quite frequently our development process was not responsive to the requirements of the combat forces.

SOVIET MILITARY TECHNOLOGY

- A CAUTIOUS METHODICAL APPROACH—EVOLUTIONARY
- DOES NOT PRECLUDE THE DEPLOYMENT OF MILITARY HARDWARE
- IS PERFORMED BY COMPETENT, RECOGNIZED ENGINEERS AND SCIENTISTS IN SIGNIFICANT POSITIONS OF POWER
- VERY RESPONSIVE TO NEAR TERM REQUIREMENTS

I gave you as a parallel the Soviet development approach, which is evolutionary in its strategy.

They never preclude the deployment of hardware because of the promise of technology, and consequently their program, in general, is very responsive to their near-term requirements. You can examine the pipeline and establish that rather quickly.

IMPACT OF TECHNOLOGY ON WEAPON SYSTEMS

	PHILOSOPHY	DESIGN	R&D TO IOO
U.S.	TECHNOLOGY EXPLOITATION	COMPLEX	LONG (5-20 YEARS)
SOVIET	FAILURE-AVOIDANCE	SIMPLE	SHORT (2-7 YEARS)

If you wanted to summarize our approach versus the Soviet Union, you would see that we take a technology exploitation strategy that results in a very long research and development to initial operational capability time. You will see that in the case of the MICV, or the Bradley Fighting Vehicle, in part is the subject of today's hearing. That was in development for 17 years.

In contrast, the Soviets take a failure avoidance approach, probably emanating from the old Stalinist days, where if something didn't work you suddenly found yourself in Siberia. Consequently their designs are rather simple, and as you would see in the case of the BMP, their armored personnel carrier, they fielded that in about 7 years, based on the best intelligence information we had.

OBSERVATIONS

- **US STILL RETAINS A TECHNOLOGICAL LEAD OVER THE SOVIET UNION**
- **US UNABLE TO USE THIS TECHNOLOGY TO BEST ADVANTAGE**
  - **TECHNOLOGY THREATENS AGE OLD CUSTOMS**
  - **NOT INVENTED HERE**
  - **GO FOR THE PROVERBIAL "BETTER CARROT"**
  - **DUPLICATION OF EFFORT**
- **TECHNOLOGY PROPERLY APPLIED WOULD REDUCE THE DEFENSE BUDGET**
  - **EXAMPLE VHSIC, RPV'S, STEALTH**
- **1986 RDT&E BUDGET REFLECTS POOR ROI**

Mr. Chairman, I would say that we still retain a technological lead over the Soviet Union but we are unable to use this technology to our best advantage. Consequently, we have spiraling defense budgets, we have a lot of duplication of efforts, we are always going for the proverbial "better carrot," and we are not really being responsive to the needs of our combat forces.

I contend that if we applied our emerging technology properly it would not increase but reduce the defense budget. Some examples are the advances we have made in microelectronics, RPV's, and Stealth technology. I also offered you the opinion that the 1986 RDT&E budget reflected a poor return on investment.

REASONS FOR POOR ROI

- THE DECLINE IN AUTHORITY OF THE OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING. THIS IS LARGELY DUE TO THE PRACTICE OF "CONTROLLED DECENTRALIZATION" ESTABLISHED BY THE CARLUCCI INITIATIVES AT THE BEGINNING OF THIS ADMINISTRATION
- THE INABILITY OR UNWILLINGNESS OF THE CONGRESS TO DEMAND CONVENTIONAL AND STRATEGIC POLICY FROM THIS OR ANY PREVIOUS ADMINISTRATION
- THE INABILITY OF THE CONGRESS AND IN MANY INSTANCES A SERVICE SECRETARY OR THE USDR&E TO TERMINATE A WEAPON SYSTEM THAT DOES NOT WORK OR THAT IS TOO EXPENSIVE FOR THE CAPABILITY THAT IT WOULD PROVIDE
- THE INABILITY OF THE DEPARTMENT OF DEFENSE TO PROFIT FROM TECHNOLOGICAL ADVANCES IN MICROELECTRONICS, REMOTELY PILOTED VEHICLES, PRECISION AND TERMINALLY GUIDED MUNITIONS AND SUBMUNITIONS – THE SO-CALLED "EMERGING TECHNOLOGIES"

The reason, Mr. Chairman and members of the subcommittee, for that poor return on investment I think emanated from the beginning of this administration when then Deputy Secretary Carlucci came up with the concept of controlled decentralization. That is where he returned a lot of authority and responsibility back to the services.

Consequently—and this is my personal opinion—you have an Under Secretary of Defense for Research and Engineering today who is not really in the decisionmaking process. He serves more in an advisory capacity, and I think when you diminish the effectiveness of the "chairman of the board," you find that you are going to get a lot of duplication of effort.

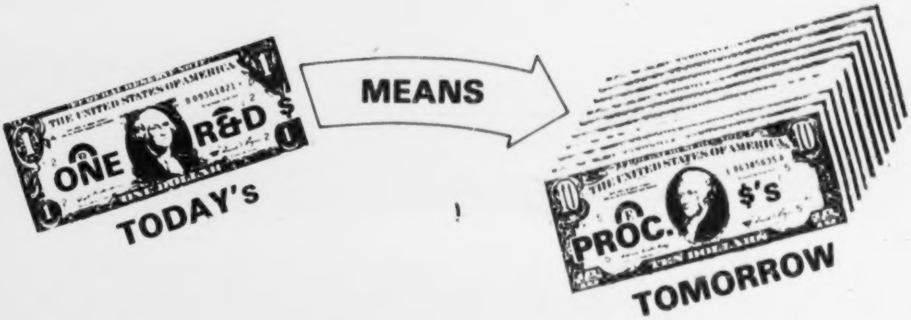
I think there is an inability on the part of the Congress, the Secretary of Defense, and many service secretaries for that matter, to terminate programs that aren't faring well in their test and evaluation phase. It is very difficult to terminate anything once it gets started. I contend that programs are like freight trains; once they get started it's very difficult to shut them down.

Finally, there is the inability of the Department of Defense to profit from the technological advances we have made; and accordingly, I think we wind up with a defense budget that gives us a poor return on investment.

DOD RDT&E PROGRAM ELEMENT COUNT

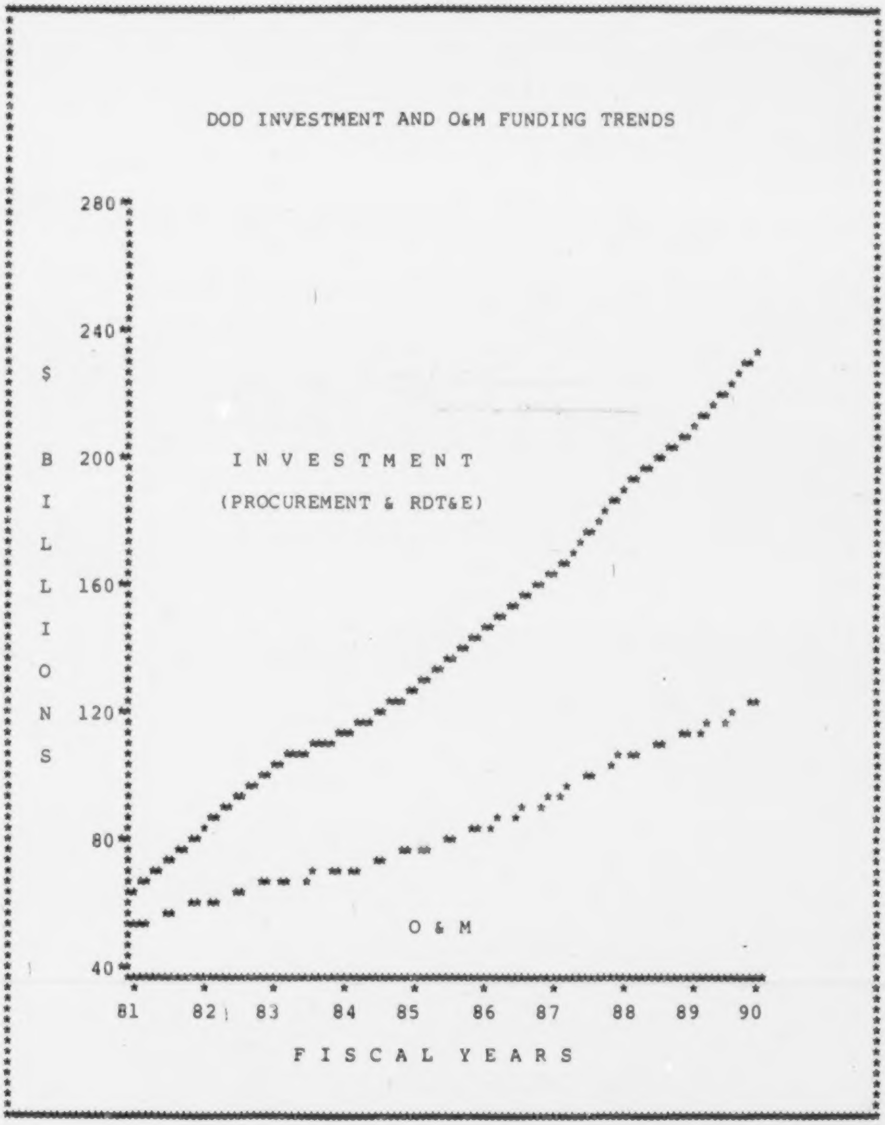
	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86
# OF PEs	610	661	705	734	724	702	722	711	746	763	805
# OF PROJECTS WITHIN PEs	1,161	1,416	1,538	1,596	1,601	1,567	1,591	1,681	1,684	1,571	1,630
# OF PEs OVER $500 MILLION	2	1	1	0	1	2	2	5	6	7	9
# OF PEs BETWEEN $100 $500 MILLION	14	18	22	22	25	31	36	30	39	46	62
# OF PEs BETWEEN $25 $100 MILLION	60	72	81	94	103	114	137	124	135	135	192
# OF PEs UNDER $25 MILLION	534	570	601	618	596	555	547	552	566	575	542

Let me say, Mr. Chairman, that the number of research and development programs is increasing, ever increasing. If you look at the past 10-year period, in 1976 there were 610 major program elements. Today there are 805. That is a 30-percent increase in major programs in the Department of Defense. You might ask how significant that statistic is. Well, keep one thing in mind: For every dollar you spend today in advanced and engineering development, it generates a requirement to spend tens of millions of dollars in the forthcoming 5- to 10-year period.



(IN BILLIONS OF DOLLARS)			
SYSTEM	R&D INVESTMENT	PROCUREMENT INVESTMENT	N FACTOR
F-14	$3.1	$33.2	11
F-15	3.0	36.1	12
M-1 TANK	1.3	18.7	14

Here are some examples. The F-14 RDT&E, $3.1 billion in development, $33.2 billion in procurement; you spent 11 times your investment. There is nothing troublesome about the size of the N factor. What is troubling is the growing number of N factors because a large number of N's in a particular category generates a requirement for logistics support that runs up your operations and maintenance account.



For example, if you were to look at the next 4-year period, this, is the situation as it existed at the beginning of this year.

Look at what is happening to the investment account, research and development and procurement and look, in contrast, to what is happening to the operations and maintenance account. The gap is growing. You will get back to that point where you were 10 years ago, where you would be buying 50 F–15's and cannibalizing 25 of them to keep the other 25 flying.

Another interesting statistic in the O&M account, and you can check with Chairman Daniel on this is that it is about $3 billion less in 1986 than it was in fiscal year 1985.

Now, today I am going to focus on an area that relates very closely to the development process, and that is the testing process. Let me give you my opinion of weapons systems.

WEAPON SYSTEM TESTS

Staff Opinion: Weapon system testing stresses quantity—not quality; often conducted under nonrealistic conditions; are often "success oriented"; are not really independent; problems have not only been around for a long time but are getting worse.

In the Pentagon, they stress quantity testing, not quality testing, often with the objective of coming up with interesting statistics, like 70 or 80 percent of the firings during the test and evaluation phase were successful. These tests, however, in general are conducted under nonrealistic conditions. They are very success oriented, very gentle maneuvers, for example, for a missile test. I will give you specific examples. Our testing is not really independent, and quite frankly the problems have not only been around for a long time but they are getting worse.

DOD MANAGEMENT TOOLS

PROCESS	NECESSITY	REMARKS
DECISION COORDINATING PAPER	ESSENTIAL	● DEPENDENT ON PARTICIPANTS SERVICE PRESSURES ETC.
TEST AND EVALUATION	ESSENTIAL	● INADEQUATE THEREFORE COSTLY ● FLY BEFORE BUY – MORE TESTING NOT BETTER TESTING ● PLAYER CONSTRAINTS
DEFENSE SYSTEM ACQUISITION REVIEW COUNCIL	ESSENTIAL	"BIRTHDAY PARTIES"

When I say they have been around for a long time you may remember the presentation that I gave you in 1977. I was critical of some of DOD's management tools. For example, the Decision Coordinating Paper [DCP], very essential, but it depends on the participants and a lot of service pressures haven't taken a look at the test and evaluation phase. It was inadequate, therefore, it was costly.

When you do quantity testing that doesn't emphasize quality, that is, does the system perform the way it is intended, you wind up not only wasting the taxpayers' money but not conveying to the combat forces the real capability of the system that he is getting that he believes is going to function in a certain way.

The Defense Systems Accession Review Council [DSARC] is essential, but if you recall—and I didn't mean this facetiously, I really meant it—DSARC's are really birthday parties. The participants get together and iron out the problems; they gloss things over and then add another candle to the system birthday cake, and that is the way it has been going.

OPINION SUPPORTED BY

Blue ribbon panel (1970's).
GAO report (June 19, 1985).
The Congress (Public Law 98-94, September 24, 1983).

I am not alone in that assessment. If you go back to the old days' Packard Panel of 1970, you find that they were very critical of weapons systems testing. There was a GAO report on June 19 of this past year, and that report was entitled "The Production of Some Major Weapons System Began With Only Limited Operation and Test and Evaluation Results." They were rather critical and I will summarize some of their findings in just a moment.

And then the Congress—I believe the sponsor of Public Law 98-94 regarding the establishment of the Office of the Director of Operational Test and Evaluation—was Mr. Courter. Correct me if I am wrong on that, Mr. Courter.

You were very instrumental, if not the author of that amendment.

GAO REPORT

SUMMARY

When major weapon systems are concurrently developed and produced, planned operational test and evaluation critical to assessing mission performance was typically not performed before beginning the production phase.

Available test results are sometimes omitted or misrepresented in reports to the congress, creating misleading impressions of a weapon systems performance capabilities.

Going back to the GAO report, this is what they had concluded, that there is too much concurrency in many instances and that the available test results are sometimes not represented to the Congress very accurately. In fact, they are misrepresented. And I am going to give you examples of that.

THE GAMMA GOAT

ARMY TESTIMONY HASC R&D SUBCOMMITTEE MARCH 7, 1975

"The AMC report, the developers report, also came in a week ago. It states that the Gamma Goat exceeds the DA standard of 90 percent readiness and that it performs its mission in an acceptable manner."—3-star General.

USER STATEMENTS SEPT. 5-11, 1976

"That —— is the worst —— vehicle that I have seen in my 17 years in the Army"—Maintenance Sgt.

"Those commies aren't stupid. If we pushed them across the border—they'd push them back"—USER Sgt.

"Best way to improve that vehicle is to line them up at the edge of the Atlantic Ocean and push them in"—3-Star General.

Let's take one for example—it's an old one and I have used it before—the Army's Gamma Goat. Mr. Chairman, in 1975 you asked, when I went out on the Reforger exercise, to investigate allegations regarding the Gamma Goat. If you recall, we pursued this with a general who appeared before the subcommittee, and there is his quote [pointing to client]. "It meets 90 percent of the Department of the Army statistics and specifications."

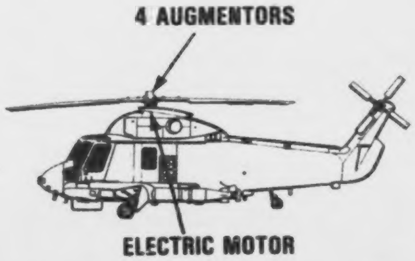
Well, when you asked that I look into it, I talked to people in the field. I talked to some two dozen maintenance types, who are very familiar with the Gamma Goat. Here are some of the quotes. "That—is the worst—vehicle that I have seen in my 17 years in the Army." Those are not national security deletions, by the way.

I suggested that after talking to about the 12th maintenance type, why don't we just take these damn things and push them over the East German border, the response was, "Sir, those Commies aren't stupid. They would just line them up and push them right back."

Having talked to a lot of enlisted types, I decided to go see some people of Colonel and above, and the best summary I got was from a three-star General who said "The best way to improve that vehicle is to line them up at the end of the Atlantic and push them," and following that, he said, "Don't ever admit that we ever built them."

THE DIVAD LOW ALTITUDE TEST

- HELO ON THE HILL
- AUGMENTATION TO "X" TIMES THE SIZE OF A HELO
- INCORRECT FREQUENCY



A WASTE OF MONEY

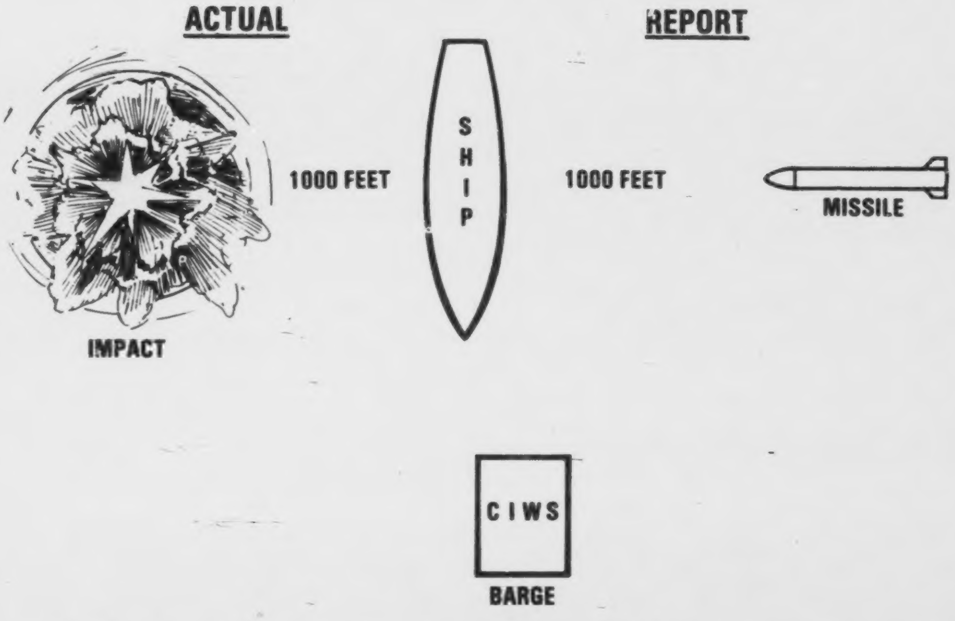
Let's look at the DIVAD. There are various opinions of the effectiveness of DIVAD. You certainly wouldn't have gotten from some of the DIVAD tests whether or not DIVAD was an effective system. For example, the Army was directed to conduct a low-altitude test, that is to determine the ability of the DIVAD radar, which is a pulse Doppler radar to engage targets coming in very low. The test plan called for putting the target on the ground.

Well, that is the ultimate in low-altitude testing, I mean being able to pick the helicopter out of that clutter. They didn't report to the Congress, that there was augmentation, called a Lunenberg lens front of the helicopter to generate doppler.

Well, the radar still couldn't see the helicopter, so they added a second, and a third, and a fourth, and what that really amounts to is they had four Lunenberg lens to generate doppler that you would not see on any Soviet helicopter. They don't come in augmented obviously, and what you got was a test that resulted in a waste of the taxpayers' money; and frankly, it gave the DIVAD a bad name.

Concerning the rest of the DIVAD testing, I am told that Wyatt Earp or Bat Masterson did not have the fastest trigger fingers in the West. The range safety officer at the White Sands test was called the "fastest trigger finger in the West." Whenever they would let out a burst from the DIVAD gun, seemingly the target was destroyed in very short order.

PHALANX TEST



The Phalanx test, I was very familiar with the Close-In Weapons system. In fact, I was with the weapons organization that built the test targets for Phalanx. In one report coming to the Congress, they were going to report that Phalanx engaged a missile at 1,000 feet from the ship. I did check that report, and what I found was it didn't land 1,000 feet from the right side of the ship. It landed 1,000 feet on the other side of the ship, meaning had that been an actual firing, the ship would have been damaged.

AIM-4D (FALCON)

Objective: Engage a 4G maneuvering target.
Test: Have target pull 4G maneuver fire AIM—4D—engage straight, level target.
Report: AIM-4D engaged a 4G maneuvering target.

I'il go next to the AIM-4 missile, the famous Falcon. It had as an objective a requirement to engage a 4G target, followed by a launch of the missile. They reported that the AIM-4D missile engaged a maneuvering target. What they didn't tell you was the target had already finished maneuvering when the missile was launched and was engaged.

M-16 RIFLE

Army knew that the ball powder caused jamming of the M-16—IMR powder did not.
Army wanted to discredit the M-16.
Contractor advised Army of the problem.
Panel found that Army allowed acceptance testing of the rifle with IMR powder but shipped ball powder ammo to Vietnam.

The M-16 rifle is a classic example how when a service doesn't want something, it will conduct tests in a manner to make it look bad. This committee authorized the establishment of a panel chaired by the Honorable Richard Ichord back in the early 1970's to investigate allegations concerning the M-16 rifle. Now, the Army knew full well that the ball powder was the principal contributor to the jamming of that rifle. Yet to discredit the M-16, the contractor, after advising the Army, was told that they could use the IMR powder for acceptance testing, but the Army would use the ball power ammo to accompany those rifles for operational use.

THE I^{2}R MAVERICK

EARLY TESTS

- OVER 40 HOURS OF CAPTIVE CARRY TESTS
- A WELL IDENTIFIED, MARKED MEASURED TARGET AREA
- NO THERMAL CLUTTER
- OPTIMIZED TARGET CONDITIONS
- A HIGH SUCCESS RATE

⇩

NO INDICATION OF THE CAPABILITY OF THIS MISSILE

Here is the I^{2}R Maverick. The early tests on that were all over a well-identified marked target area with no thermal clutter. This is an 8 to 14 micron Seeker, that is it guides on the temperature differential between the target and its background. They were all success oriented tests.

I can remember when the Air Force representatives came over and told me that they could acquire tanks at 65,000-foot slant range with the I^{2}R front end. I did a very quick mental calculation and said "That is absolute nonsense. You cannot do that." They offered me a ride in an F-4. I took it, went down to Eglin, flew it, and it confirmed my judgment, that you can only see those targets at a fraction of the range that was advertised.

In the last IOT&E tests that were conducted about 2 years ago, they actually had contractor personnel monitoring the imagery being received to encourage the pilot when to fire. This is really, I think, doing a disservice, to the guy in combat, who thinks that this missile is going to perform in a manner that is advertised. I'll say it again as I may have stated it before, I think the employment of the Maverick missile is going to wind up costing us as many pilots as it costs the enemy targets. Yet, you know, this program continues.

Let me give you another example of how when a service doesn't want something it will attempt to discredit it. There is a Navy program called Skipper. Skipper is a very low-cost fix to the existing Pave Way series of bombs. The Navy came up with a very simple Humphrey Gyro to add to the Skipper to give it a very good capability. The Air Force, in contrast, wanted to develop something called a low-level laser-guided bomb which cost about five times what the Skipper was going to cost.

At this committee's insistence, the Air Force was required to test the Skipper side by side with the triple LGB. During the first test, the Skipper, with its large warhead, came within 18 feet of the target. Going over the target, however, it did hit the ground and bounce along. The Air Force wanted to report back to the Congress the fact that the miss distance on the Skipper was 2,000 feet, and fortunately there was a very honest General down there who said "Absolutely not. I wouldn't want to be within 18 feet of a 500-pound bomb, so that is not a failure. That is a success."

But to this day, the Navy is very excited about the Skipper. It was reported on ABC as a weapon that made it through the bureaucracy. Secretary Lehman attested to the fact that it is a very good weapon. There is still no Air Force interest, I think, principally because there are still some factions there who are interested in buying the low-level laser guided bomb (LLLGB) which was terminated fortunately, I think, by Secretary Vern Orr.

JOINT LIVE FIRE TESTS [JLFT]:

Objectives: Evaluate effectiveness of U.S. armored systems and aircraft against Soviet munitions; evaluate effectiveness of U.S. munitions against Soviet armor/A.C.

Having talked about the negative parts of DOD testing, I would like to shift gears and talk about something called the joint live fire test [JLFT], which came out of the DOD, initiated by Colonel Jim Burton who you will be hearing later this afternoon. I think this was probably the best thing that has happened to testing in the past decade in addition to Public Law 98-94.

The objective of joint live fire test is to expose our armor aircraft and ships to Soviet munitions, expose Soviet hardware if we can get it to our munitions and establish the effectiveness of these systems through this kind of testing. Unfortunately, Colonel Burton was unable to get the Navy to sign up to doing vulnerability testing on some of our ships.

If you remember about 12 years ago, Mr. Chairman, I was very critical of the survivability of some of the platforms that we have got in the Navy. Go back to the experience with the U.S.S. *Worden* in Vietnam, when it didn't even take on a direct hit, yet suffered severe damage from one of our own missiles that was inadvertently fired and flew over it. Look at some of the ships we have in the inventory today, and I couldn't tell you in an open session how vulnerable they are to keel shock, that is a certain amount of high explosive, not even hitting the ship; yet we do very little about it, when, in fact, for a very modest investment we can really enhance the survivability of our ships, the crew, and the equipment.

We can protect our wave guides, for example, so that we are not dead in the water when a warhead goes off in the proximity of the ship, but we haven't done that. We have been very remiss in doing that, and I would hope that if this committee focuses on anything this coming year, it is the vulnerability of our major surface combatant ships, as well as armor, as well as aircraft, because joint live fire testing should not be confined only to the Army's armored vehicles.

JOINT LIVE FIRE TESTS [JLFT]: (CONTINUED)

Staff opinion: JLFT is essential to establish combat effectiveness of weapon systems; ancillary effect of telling you how not to use a system; JLFT program should be expanded.

Here is my opinion of the joint live fire tests. I think I have already covered it. It has an ancillary effect, however, of telling you how not to use a system. Regardless of how the situation comes out on the Bradley. I think something that will emanate from the joint live fire test is this is how you shouldn't use it if indeed it is going to continue in production. I think the joint live fire test should be expanded.

JLFT FUTURE

May be diluted/canceled by USDR&E.

I think the prospects for that are poor; because of this episode involving the Bradley, I think the whole effort is going to be diluted or canceled by the Office of the Under Secretary of Defense for Research and Engineering, which I think would be a traumatic mistake. If you share with me the opinion that this type of test is valuable, then I think you are going to have to require the Department of Defense to expand this program.

I talked earlier about you are being slow-rolled on Public Law 98-94, the establishment of the Office of the Director of Operational Test and Evaluation. I can give you plenty of good evidence. Russ Murray, the former Assistant Secretary of Defense for Plans, Analysis and Evaluation, back in 1978 wrote a memo to then Deputy Secretary Charles Duncan.

If you recall, the function of operational test was given to Assistant Secretary Murray, and it was given to him with 11 people and a very modest budget. He wrote back to Secretary Duncan after evaluating the situation. "You either give me more people or else take this thing back, because it is a sham right now," and that is an exact quote. I have a copy of his memorandum right here which I would like to insert in the record.

[The following information was received for the record:]

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

PROGRAM ANALYSIS
AND EVALUATION

July 22, 1978

MEMORANDUM FOR THE DEPUTY SECRETARY OF DEFENSE

SUBJECT: OT&E Organization

Charles:

I rarely need a secretary on Saturdays, and as a result do not have one in the office today. Please pardon whatever typos may follow.*

I have thought about your memo of yesterday that you handed me this morning. You suggested in it that if the OT&E function is to be returned to Bill Perry, I should retain "a small team of people" to "follow both plans and testing for both OT&E and DT&E". In preparation for our meeting this afternoon on that subject, I think it would be useful for me to lay out for you 1) how the history of this whole OT&E matter looks from Russ Murray's vantage point, 2) the reasons behind my recommendation to you earlier this week that you consider returning the OT&E function to Bill Perry, and 3) my reaction to your memo.

1. What It All Looks Like From 3E 966

When I came aboard a year ago last winter, Harold explained to me that he wanted OT&E to be completely independent of DDR&E -- a point recommended by the Blue Ribbon Panel in 1970 (excerpt from "Recommendations", Appendix F, Blue Ribbon Panel report: "1. Establish an Operational Testing and Evaluation Group, with civilian leadership, within the Office of the Secretary of Defense, reporting directly to the Deputy Secretary of Defense"). He said that up to that point he had been thinking of doing that by putting OT&E under a new position -- the Undersecretary for Evaluation, who would also be responsible for PA&E and the Comptroller. However, he had then decided against an USD(E), which left him without an organizational spot for OT&E. He asked me whether I would be willing to take it on as part of PA&E. (The suggestion has been his from the start, not mine.)

In my memo of April 25, 1977 to him, I agreed to do that; "About three weeks ago you asked me whether I thought PA&E should take over the function of OT&E. My answer is yes."

*Retyped Monday, July 24, 1978.

In that memo, I also noted: "As for the OT&E move, that would transfer 30 or 40 slots from DDR&E to PA&E."[4] That number was based on the then-current staffing of the DDT&E office which, being the child of the Blue Ribbon Panel, I had assumed was devoted to OT&E and would be transferred to PA&E. Of course that turned out not to be the case, but my assumption was not challenged at the time I made it, and I mention all this merely to establish the general size of the OT&E team I had in mind and on which I based my agreement to accept the responsibility.

Next came the revelation that the DDT&E staff was also involved in DT&E, raising the problem of which members of that staff should remain with DDR&E to carry on the DT&E functions. Bill suggested that we convene the DSB to set up an impartial (!) group to study that question and make a recommendation to us. After protracted study, the group made their recommendations -- none of which really addressed the question of which people should stay with Bill and which should come to me. Instead, they recommended that Harold change his mind about the whole idea.

The resolution of the personnel transfer question was eventually made quite independently of the DSB's labors, with the result that PA&E was awarded 8 professionals (even the DSB had recommended 23 professionals for the OT&E job) and 3 secretaries -- a fraction of those I assumed I would inherit when I agreed to accept the new responsibility in the first place. I considered that shortage so serious that I contributed 4 of my own slots to plug some of the gap and get the operation under way on at least an interim basis.

The next battle came over the drafting of the charter and the writing of DoD Directive 5000.3. That also involved prolonged negotiations, involving not only you and Bill and me, but even Gene Fubini. The issue, after an immense investment of time and effort, was finally resolved over Bill's and Gene's objections by Harold, and the Directive was signed. Thus, a full year after I had agreed to take on the responsibility, I had, by dint of seemingly endless and frustrating negotiation, gotten a satisfactory charter and perhaps a third of the people I needed.

To remedy the personnel problems, I sent Harold a memo two months ago asking for an authorization for 23 professionals and 7 secretaries for OT&E. I explained that I needed at least that many to be able to cover the necessary functional (e.g., ASW, AAW, etc.) and technical (e.g., Statistics, radar, E/O, design of experiments, etc.) areas, as well as to keep up with the large number of operational tests, both JOT&Es and new weapon tests. I also said that I was not really sure that 30 people would turn out to be enough in the long run, but that I was sure there was no danger of overstaffing in my proposal. I said, too, that "The part (of my personnel request) applying to OT&E I consider essential." I meant just that, and I still do.

Last Wednesday, you told me that after consulting with Bill Perry, you had decided to grant me 3 more professionals for OT&E, but with some license on my part to apply to OT&E at least some of the other 3 professionals you had agreed to for the rest of PA&E. I carefully considered that response overnight, and gave you my new recommendation the following day, which brings me to the next stage.

2. The Reasons Behind My Current Recommendation

I decided to, and did, recommend to you that 1) all the spaces you had agreed to should be applied to the traditional part of PA&E, 2) the OT&E function be returned to Bill Perry, or wherever else you might choose to assign it, and 3) the people I had hired for or transferred to the OT&E function be allowed the choice of remaining there under the new leadership, or transferring to the other parts of PA&E, bringing their spaces with them.

I made that recommendation in complete sincerity, and I'm most relieved that you've accepted it in that spirit. I am here to serve you and Harold, not to add to your problems, and not to build any empire.

I also made that recommendation with a deep sense of frustration at having been, in effect, defeated by those who have fought this transfer from the beginning. If that sounds paranoid, I suggest you re-read the sections of the DSB's recent report on the acquisition process that deal with the transfer of OT&E to PA&E; the vituperation and abuse is astonishing. You should be under no illusions that this move has been fought by the engineering community and industry. They may be right (though I strenuously disagree with them), but there is no denying that they have fought it hammer and tongs, and I don't like to admit that they've won. But they have. One of the things I finally had to force myself to recognize was just that. To continue to clutch to my breast that hard-won responsibility for OT&E without the people to carry it out would not be winning -- it would be loosing, and in a worse way than simply conceding the defeat and abandoning the sham.

Worse than the sham, however, were the risks involved. Sooner or later, I would be faced with an OT&E on a system in which I did not have the necessary expertise. That would leave me with the choice of trying to oversee the testing anyway, and risking a serious error, or abandoning the test, and risking the deployment of a deficient system. Either way, I would be vulnerable to charges of incompetence. And in an environment so evidently hostile to PA&E's having any role in OT&E, I have no doubt that such failings would be widely (and correctly) advertised. So not only would you and Harold not be getting proper OT&E, you would also be risking the rest of PA&E by opening a chink in its armor of competence.

One other factor that bore on my decision was that any move to grant only 3 more professionals would be seen widely as a lack of firm support on your part and Harold's. In a situation with as many vultures circling overhead as this one, I have to have not only firm, generous, and continuing support, but the clear perception of it on all hands.

3. My Reaction to Yesterday's Memo

I have thought about your memo for at least the three hours that I've had it, while mulling through the above description of what's already behind us. I'm trying to keep an open mind, and not to simply give you a knee-jerk negative response. I'm having trouble, I'll admit. But here are my views.

Compared with last Wednesday's, this new proposal would:

1) Eliminate my control over the experimental design of operational tests.
2) Add an entirely new responsibility in the developmental testing area, requiring even more people and expertise.
3) Do nothing to correct -- and possibly worsen -- the problem of gaps and holes in the span of expertise I need to be able to even comment responsibly on operational testing.

I think this proposal would reduce me to the role of kibitzing Bill Perry, and I just don't want to do that. I would deeply resent his kibitzing me. I don't want to be a snoop looking over his shoulder and bugging him. And I most certainly don't want to tell him how to develop new systems.

I also think this proposal would leave you with nothing more than a mere facade of independence in operational testing. Independent OT&E requires both authority (which 5000.3 gave me) and resources (which I do not believe I have). But you cannot get independent OT&E on the cheap. It's a big undertaking to do it right. You certainly can't get it by asking me to bug Bill.

If you are serious about independent OT&E, and willing to pay what I believe the price to be, I'll take it on for you. I agreed to do that well over a year ago, and I stand by my offer. But the intervening period has sapped far too much of my time and effort, and it's not doing relations between Bill and me much good, which I find awkward and distasteful. I'm exhausted over arguing about charters and authority and people and expertise and what's operational and what's developmental and why testing should or shouldn't be combined -- in an effort simply to do what I understood Harold to have in mind when he asked me in the first place. The whole thing has become so convoluted that I'm beginning to think I must have misunderstood his offer.

I need one of two things from you and Harold. One of them is evidence that your commitment to truly independent OT&E is serious, and that you have enough confidence in my judgment to give me the support I say I need to do a job at PA&E standards of competence. Or, I need relief from this tiresome internal war so that I can get back to the other things I have to do. I think you should choose the first alternative, but if you aren't persuaded, then please pick the other one now.

Russell Murray, 2nd
Assistant Secretary of Defense
Program Analysis & Evaluation

Mr. BATTISTA. It starts off with, "Charles, I rarely need a secretary on Saturdays and as a result do not have one in the office today. Please pardon whatever typos may follow."

And he goes on to say: "To remedy the personnel problem I sent Harold a memo 2 months ago"—that is Harold Brown—"asking for authorization for 23 paraprofessionals and 7 secretaries for JOT&E."

> I explained that I needed at least that many to cover the next ASW, AAW and technical statistics radar electro-optics design and experiment areas, as well as to keep up with a large number of operational tests, both JOT&E's, and new weapons tests. I also said I was not really sure that 30 people would turn out to be enough in the long run, but that I was sure there was no danger of overstaffing in my proposal.

At the end he states:

> Worse than the sham, however, were the risks involved. Sooner or later I would be faced with a JOT&E on a system in which I did not have the necessary expertise.

Well, Mr. Chairman, he was asking for 23 to 30 people just to get started. Today you have 17 people in the Office of the Director of Operational Tests and Evaluations with a total budget of $11 million, and if you think any organization with an establishment or with a work force of that number with a $11 million budget can oversee effectively operational testing, then I would submit that we do away with the office, because we are wasting $11 million of the taxpayers' money.

Either do it right, or don't do it at all, is the message.

THE BRADLEY CHRONOLOGY

- **JOINT US/FRG STUDY OF 1964 ESTABLISHED THE REQUIREMENT FOR MECHANIZED INFANTRY TO BE ABLE TO FIGHT MOUNTED**
- **MICV INITIATED IN 1965**
  - **A RELATIVELY SIMPLE FOLLOW ON TO THE M–113**
- **ARMY VICE CHIEF REJECTS EARLY DESIGN PROPOSALS AS TOO BIG, HEAVY, COMPLICATED IN 1968**
- **CASEY BOARD 1968 APPROVED A SMALLER, LIGHTER LESS COSTLY 12 MAN VEHICLE WITH A 20MM CANNON AND FIRING PORTS**

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INCONSISTENT STORY

Now, I would like to switch over to the Bradley, and somehow not to build a weapons' system, becuase the Bradley is a classic example. The Bradley's history goes back about 28 years.

In fact, in the formal sense, it goes back to 1964. There was a joint study with the Federal Republic of Germany, and this study established the requirement for the infantry to fight from a vehicle. The MICV was initiated in 1965, was supposed to be a relatively simple follow-on to a $26,000 a copy vehicle called the M–113, and there was a lot of turmoil over the program at that time.

The Army Vice Chief, who was then Ralph Haines said, "Hey, look, these design proposals you are giving me are too complicated. This vehicle is too big. It is too heavy. It is too sensitive."

"I don't want it. I am looking for something that can get infantry troops up to the front lines to support my armor. Don't tell me about engaging other vehicles."

So, he, as a consequence of that concern, convened a board that was under Brig. Gen. George Casey called the Casey Board. In 1968 they approved a smaller, lighter less costly MICV, which is what the Bradley was called back then, the mechanized infantry combat vehicle [MICV].

However, in the spirit of compromise they came out with sort of a conflict. What they came up with was a stabilized cannon for this smaller low-cost lighter vehicle, and that I think served as the epic for the principal issue on the Bradley Fighting Vehicle, and that it was supposed to be antipersonnel.

THE ISSUE

Anti-personnel was the highest priority task but the 20MM stabilized cannon was not an anti-personnel weapon.

It was stated, this mission was stated as the as the army's highest priority. However, the stabilized cannon, was not an anti-personnel weapon, so you can see the genesis of the turmoil.

BRADLEY CHRONOLOGY

POST 1968

1969 MICV intended as a companion vehicle to MBT–70.

An austere MICV was judged to be nearly as effective as the MICV—Sheridan power train, suspension, simple cannon.

Approved by Army in 1970.

DEP SEC DEF approved DCP in 1972.

Within the year the DCP was amended: Simple weapon abandoned; added the Bushmaster.

Austerity was illustory.

If you look at the Bradley post 1968, the Army advertised this was going to be a companion vehicle to the MBT–70. This was still another calibration point in identifying this conflict that was going to take place, because if this thing was going to go up there and fight side-by-side with tanks it was going to get blown off the face of the Earth.

That is one thing I think you can state categorically regardless of the amount of testing the army does and there is plenty of evidence to support that. If you put this thing side-by-side with tanks it gets blown away.

That is why we put the kind of armor we did on the M–1 tank, and that contains a crew of four. It makes no sense to put a crew of nine in the same area with the protective vehicle with the standoff armor capability that Bradley's have.

They decided again that the vehicle got too costly and complicated so they came up with an austere MICV. This was now a vehicle that was going to use the Sheridan power train, Sheridan suspension system, and kind of off the shelf of parts. They did a study on that and they concluded that the austere MICV was just as capable as the one that they had in design, and this was approved by the Army in 1970, and the Secretary of Defense approved that development concept paper in 1972.

However, within 1 year, the whole thing, the whole concept of austerity was lost, because somebody made the decision to put a vehicle rapid-fire gun system on this thing, and again that added complexity, it added more capability to the system, and the whole concept of austerity became an illusion. It just wasn't there.

Now, to show you how adding these things sounds simple, but is complex, let me say that if you wanted to go from armor protection against the 14½ mm to a 23 mm, that would add about 4 tons in armor to the tank. If you wanted to change the horsepower to weight ratio by just a few, 2 to 5, that would result in about 5 percent increase in the weight you would add to that tank.

If you wanted protection against the 20-pound mine, that would add another 5,000 pounds to the tank. If you wanted protection against the 40-pound mine, it is not linear, that would add as much as 18,000 pounds to the weight of that APC, so what is happening is you have got a series of considerations here that change the vehicle characteristics significantly. The program was not new in 1972.

It was around since 1964, and everybody and his brother was perturbing the program and trying to put in what they wanted.

BRADLEY CHRONOLOGY

POST 1972

- MICV (XM 723) TEST RESULTS WERE POOR
- WEIGHT INCREASED TO 42,000 POUNDS
- GAO CRITICAL OF MICV IN 1974
- MID–1974 ARMY CANCELLED ARMORED RECON SCOUT VEHICLE (ASRV)
- MICV IDENTIFIED AS ARSV REPLACEMENT
- 1976 STUDY TO PUT TOW ON THE MICV
- 1976 SEC HOFFMAN CHALLENGED MICV MISSION
- LARKIN STUDY RECOMMENDED TOW

⇩

MICV WAS NOW A TROOP CARRIER, SCOUT AND ANTI ARMOR VEHICLE

Now let's take the chronology from post-1972. The tests results were very bad. The weight had increased. It was now a 42,000-pound vehicle.

The GAO was very critical of the MICV. The army then in 1974 canceled something called the Armored Reconnaissance Scout Vehicle Program, and then somebody had the bright idea, let's make the MICV, which is now the Bradley Scout Vehicle, which was a very silly idea.

It is sort of like trying to hide the Refrigerator in the Mormon Tabernacle Choir because this thing is now 10 feet tall. To use it in a scouting mission you would have to wonder about it. It is very, very big.

If you look at the BMP in contrast to the Bradley, the BMP is about 85 inches tall. I have sat in it. It is a little uncomfortable.

Russ Murray sat in it. Other people have suggested to raise the height 4 inches. It has a very low silhouette in comparison to the Bradley.

I am not giving you a qualitative analysis of the BMP against the Bradley. I am not in a position to do that across-the-board.

I am just giving you one aspect of it. In any event the program was getting challenged by Secretary Hoffman, Secretary of Defense Schlesinger, and this in turn precipitated the Larkin study under

General Larkin, and then what happened was that out of all of this came the requirement to put a two-man turret on the MICV, on the Bradley, and now you had a troop carrier, you had a scout vehicle, you had an antiarmor vehicle, and when you add up the characteristics of all of these things, you may come up with a null set, that is it does a lot of things very poorly instead of a few things very well.

IMPACT—MICV NOW CARRIED 9, NOT 11-MAN CREW BECAUSE OF THE 2-MAN TURRET

Significance: Original requirement was to carry 12; driver, gunner, vehicle commander stay with vehicle providing a dismounted infantry squad of 6; 1978 study by the infantry school evaluated effectiveness of 9, 7, 5 man squads; five man squad was judged as less than 20 percent as effective as a 9 man squad; results confirmed by operational tests at Fort Carson July—November 1979.

Well, let's look at the impact of this decision now to put the two-man TOW-Bushmaster turret on the MICV. Here is the impact.

Now it didn't carry 11 men, it carries nine, because you needed that space for the 2-man turret.

Now what is the significance of this?

The original requirement for a fighting vehicle was for 12 men. Then we went to 11. Now we are down to 9.

Now if you go back and look at the infantry school study of 1978, they concluded the MICV needed a nine-man squad. If you go to a six-man squad, a five-man squad, or a seven-man squad, we lose a lot of effectiveness, that is a five-man squad is only 20 percent as effective as a nine-man squad, so you can see how adding a two-man turret to this thing now costs you capability in terms of its original mission, which was to take the squad, the nine-man squad up to the lines, in support of the armor.

Now, you may say well, that was just a study, how good is that? The results were confirmed by the operational tests at Fort Carson in 1979 during the period of July to November. In fact, I have got some quotes back in my office of the tester who said this just doesn't cut it.

Now, there were other perturbations as well, and other documents to support the fact that this vehicle was being made so hybrid that it didn't do anything very well. These are not my statements now. I will give you an example.

There is a message sent by Gen. Don Starry who at that time was the Commander of the Training Tactics and Doctrine Command, and in this message, in fact, I will give you the daytime group, it is 1614 November 14, 1977, if you want to go back and check it out.

In the message he implies, "Who in the hell decided to put this TOW on this fighting vehicle?"

He said, "If I am going to effectively use TOW, then I am going to be 3,000 meters from the order of battle, and therefore it can't provide very good infantry support vehicle for armor."

Now if you put this thing up where the battle is going on then TOW is maldeployed, so what are we doing here?

We really ought to be developing something else called a heavy infantry fighting vehicle. You can understand the political nuisance there. That message was quickly cast aside, but I will say one thing, even General Richardson who didn't agree with General

Starry at that time wrote a memo saying, "I think it was a mistake to put TOW on the MICV."

All of this exists. I can give you all of the references chapter and verse on opinions expressed by generals and by people in positions of responsibility.

Now, it is interesting to note that during the Carter years, I think it was in 1977, the OMB made a decision to terminate the MICV. They said it is too expensive, and President Carter was going to uphold that decision, and Russ Murray at that time said, why don't you give them one more year of R&D and also make them look at the alternatives, and in effect that kept the program going, and it was in 1977 when I appeared during the markup before the R&D Subcommittee, and said, I think we ought to terminate this and I think we ought to terminate it because its mission has been so diluted by adding capability that I don't think it can really do its job.

That recommendation was not accepted, and I haven't spoken out in favor of or in opposition to the Bradley since that date, until December 5 when Mr. Bennett, Mr. Dickinson and several other members of the subcommittee asked me about its survivability.

BRADLEY ISSUES TODAY

Main issue—What's it for?

If used by infantry on the defense—how can it survive enemy weapons?

Overwatch—if it stays back its effect may be negligible

If used on offense—how can it see dug in enemy troops? How about its size? What about the loss of effectiveness because of the 6-man squad?

Let me talk about the main issue today before I get into just a quick critique of the tests. These are the Bradley issues today.

What is it?

What are you going to use it for?

I mean how do you resolve all of the inconsistencies in the stores that have been going around for the past 17 years?

In fact, I am sorry, it is 22 years right now. If it is going to be used by the infantry on the defense how is it going to survive the small weapons. If you are going to use it for overwatch, is its impact negligible by virtue of its standing back?

If you are going to use it on offense, how good is its visibility. These are the questions you have got to develop with the Army before you come to any conclusions on the results of the tests. I think you have got to ask how are you going to use it, and if you are going to put this thing up there side-by-side with the tanks, I will state unequivocally it gets blown away.

Now I can't get into the specific details. I can tell you that in the tests of some armored vehicles loaded with a very modest supply of weapons, like the Soviets have, and like we have, if you put a round right through that stream you will have nothing but a crater there plus a piece of aluminum.

PREPARED STATEMENT OF ANTHONY R. BATTISTA

Mr. Chairman, Members of the Subcommittee.

On December 5, 1985, I appeared at your request before this subcommittee to offer my views on the Department of Defense Research, Development, Test, and Evaluation program, the potential impact of Gramm-Rudman on the RDT&E program and ways to improve our conventional war-fighting capabilities and deterrent posture.

Some of the more significant observations that I made were:

- The Department of Defense budget request for RDT&E in recent years has been too large in terms of the return on investment.
- The Pentagon has been unable to use these surplus funds and accordingly, $3.3 billion in defense appropriations expired last year.
- There is too much duplication of effort in the RDT&E program.
- There are too many RDT&E programs and projects.
- The number of RDT&E programs and projects has risen sharply over the past ten years--by nearly 30 percent.
- The large number of RDT&E programs, coupled with the high number of production lines will, if not brought under control, generate an exorbitant outyear mortgage for defense procurement, operations and maintenance, military construction, etc.
- The Department of Defense has failed to capitalize on advances that have been made in high technology--the so-called emerging technologies--that could indeed result in enhanced conventional capability and deterrence and a lower defense budget.
- There is too much emphasis on how much we spend on defense rather than how the money will be spent for defense.

Mr. Chairman, I gave the detailed rationale and data to support these observations. Today, in accordance with your request, I will talk about a most important and related issue--that of weapons systems test procedures, policy, and practices as I see them.

You requested that I use the Bradley Fighting Vehicle program as a specific example of how test procedures evolve during the development process and in response to your request I have compiled a chronology of the Bradley. I will not during this meeting recommend that the Bradley be terminated or that it receive your full support. I recommended that the system which was called the Mechanized Infantry Combat Vehicle be terminated in 1977. I was not the only one who recommended its termination. The Office of Management and Budget made the same recommendation to President Carter. Defense Secretary Harold Brown appealed the recommendation and the OMB decision was overturned.

My recommendation was not accepted by the committee and I have not commented in favor of or in opposition to the Bradley since that date.

On December 5, 1985, however, Mr. Dickinson and other members of this subcommittee asked for my opinion on the survivability of the Bradley. This is not an easy question to answer because the answer depends on how the vehicle will be employed on the battlefield by the Army. I can state with high confidence, however, that if it is the Army's intent to have the Bradley fight side-by-side with the M-1 tank then it will be extremely vulnerable. The Bradley development program was modified many times over during its 17-year development history. The key issue is whether this vehicle bears any resemblance to the original requirement and whether its high cost can be justified in terms of what it can do on the battlefield.

The question of whether or not the committee should continue to authorize funds for the Bradley lies within the jurisdiction of the Procurement Subcommittee. The Procurement Subcommittee will conduct an extensive hearing on the test results on or about February 18, 1986, and that investigation should surface the key issues and generate the appropriate response.

Test and Evaluation Process is Seriously Flawed

In addressing some specific problems in the weapons systems development process on December 5, I stated that there are many systems in the Department of Defense that are in as bad or worse shape than the Divad Gun System. I stand by this statement and would add that the test and evaluation process is seriously flawed when the Pentagon repeatedly obligates millions and in some cases billions of dollars in defense appropriations before we find that the system does not work.

These flaws in the test and evaluation process have been known for many years. The Blue Ribbon Panel of the early 1970's recognized serious deficiencies in the T&E process. I commented in my 1977 annual presentation to this subcommittee, which was chaired by the Honorable Richard Ichord, that the

Department of Defense management tools for RDT&E, while well intended. were inadequate. I emphasized at the time that the Defense Systems Acquisition Review Council amounted to little more than birthday parties for weapons systems. I expressed the opinion that the Department of Defense in many instances conducted success-oriented tests in unrealistic conditions and that the emphasis was on quantity testing rather than quality testing.

The General Accounting Office in its report of June 19, 1985, entitled, "Production of Some Major Weapons Systems Began With Only Limited Operational Test and Evaluation Results," concluded:

> "When major weapons systems are concurrently developed and produced, planned operational test and evaluation critical to assessing mission performance was typically not performed before beginning the production phase ... available test results are sometimes omitted or misrepresented in reports to the Congress creating misleading impressions of a weapons system's performance capabilities ... "

Mr. Chairman, I stand behind my assessment of 1977 and agree with the GAO findings and the establishment of the Office of the Director, Operational Test and Evaluation which was required by Public Law 98-94. I must add, however, that the situation, in spite of the concern and action of the Congress, has worsened.

At the outset I will state that there are many weapons systems that are thoroughly tested in an objective manner by the Department of Defense. There are a number of systems that are not tested properly and it is most unfortunate that this number grows larger every year. This fact cannot be taken lightly. The end result of inadequate testing could result in the loss of many lives because systems are fielded that do not perform as believed or expected by our combat forces.

Poor Performance/Good Results or Good Performance/Poor Results

Mr. Chairman, there are numerous examples of how weapons systems have not been properly tested and how the results have been misrepresented to the Congress. There are also a number of examples of how the services will alter the results of tests of weapons systems that perform very well simply because there is no service interest in the system. I would like to cite just a few of the many examples:

The Divad Gun System. There was a requirement to test the ability of the

Divad radar to acquire a low-flying target. The Army test would place the helicopter on the ground which would be the ultimate low-altitude test. What was not reported, however, was the fact that the helicopter was located on a rise with the engine removed and replaced by an electric motor to turn the rotor. Additionally, a target augmentation device was added and all of this resulted in a meaningless test and a waste of the taxpayers' money. I would note that the radar with target augmentation under unrealistic conditions was still unable to acquire the target and accordingly, three other augmentors were added before the Divad radar could engage the target.

The Imaging Infrared Maverick Missile. In 1977, I received an Air Force briefing stating that in captive carry tests of the missile seeker, the missile was able to identify tanks at 65,000 feet slant range. I did some rough mental calculations and responded that this was impossible. I was offered a flight in an F-4 aircraft which I accepted and I confirmed my opinion that the missile seeker could identify tank targets at only a small fraction of the advertised range. Maverick missile testing subsequent to that date has always occurred under unrealistic conditions in the absence of thermal clutter in a well-defined, well-marked target area. It is my understanding that contractor participation in some of the tests was most unusual in order to ensure success. My assessment of the Maverick missile is that it is at best a 50 percent missile and I stand by the opinion that we will lose as many pilots firing the Maverick as the enemy will lose targets. Regardless, the Congress continues to appropriate funds for the Maverick missile.

The M-16 Rifle. This is a classic example of how a service will modulate a test plan to ensure that a weapon that it does not want will look bad. The situation on the M-16 rifle became so grave during the Viet Nam era that this committee appointed a special panel, chaired by the Honorable Richard Ichord, to investigate allegations over the Army's use and testing of the M-16 rifle. The panel found a series of improprieties that "bordered on criminal negligence." As a specific example, the Army was advised that a principal cause of the rifle's jamming was the use of Ball powder ammunition. It was a well-known fact that the use of IMR powder just about obviated the problem yet the Army insisted on the use of Ball powder ammunition because the Army favored the M-14 rifle over the M-16.

The AIM-4 Falcon Missile. This was an air-to-air missile that was suppose to engage maneuvering targets. Some Air Force personnel, based on deficiency reports, wanted to test the missile against a maneuvering target. Under heavy pressure, however, the missile was fired at a target that had completed its maneuver and was flying straight and level. The Air Force reported that the missile successfully engaged a maneuvering target but did not point out that the maneuver had occurred long before the missile was launched. A review of history will show that an Air Force General in Viet Nam requested the removal of the AIM-4 missile from his aircraft.

The Skipper Laser-Guided Bomb. Here is another example of how a service will try to make a good weapon system look bad. The Air Force was developing a very sophisticated Low-Level Laser-Guided Bomb (LLLGB) to replace the current series of Paveway laser guided bombs. The Navy, in contrast, was developing a very simple low-cost fix to the existing Paveway bomb, referred to as the Skipper. The Air Force wanted no part of the Skipper program but this committee insisted that it be tested side-by-side with the LLLGB. I can state without equivocation that the Air Force intentionally misrepresented the results of the tests. I had a copy of the telemetry data clearly showing that the results were not properly reported to the Congress. During the comparative test between the LLLGB and the Skipper, some Air Force personnel wanted to report a 2,000 foot miss distance of the Skipper when in fact its miss distance was only a few feet. An Air Force General, who was observing the test at Eglin Air Force Base, refused to send such a report. Indeed the Skipper has continued to pass its tests within the envelope but the Air Force still has no interest in the Skipper even though the Secretary of the Air Force has terminated the LLLGB.

AWACS. Here is an example of how an exaggeration of test results almost caused the termination of a good system. The initial report on AWACS testing to the Congress stated that the AWACS was invulnerable to jamming. Until this time I had never questioned the utility or capability of the AWACS. I did not believe, however, that anyone had ever built a radar that was invulnerable to jamming. This committee ordered more realistic tests of the AWACS against Navy EA-6B jamming aircraft. I participated in those tests and found that the AWACS could indeed be jammed, however, it was still the best airborne early warning radar built and the system was subsequently procured. I have many examples of how AWACS test results were exaggerated.

Close-In Weapons System. This system had never been tested for lethality until the Navy was directed to conduct lethality tests in 1975. The results of the test showed that the system's effectiveness was marginal against some current and projected anti-shipping missiles. The tests highlighted the need for improvements, many of which have already been initiated.

Mr. Chairman, these are only a few examples of bad testing but they do represent both the past and present situation. They are not isolated cases.

This Congress will have before it this year requests for billions of dollars for weapons systems that have not been adequately tested. I would be most pleased to give you some examples in executive session. In many instances, it might be wise to proceed with the procurement of systems with known deficiencies because the deficiencies could be minor or in fact the system with its problems could still have a high cost/performance index. I wish to emphasize that I have never seen a conventional weapons system that is 100 percent effective. We should not expect total effectiveness. Technology is perishable. If we build a high-performance radar, the enemy builds a high-performance jammer. We then make improvements to the radar and he makes improvements to the jammer--it is an iterative process.

The effectiveness of a weapons system and the impact of its deficiencies can only be established through realistic and objective testing. The test process should be accompanied by complete candor among the Office of the Secretary of Defense, the Congress, and the services, but this candor does not exist at this time.

The Prospects for Better Testing are Poor

I submit that objective testing is on the decline and unless the problem is checked at this time, there will be a tremendous effort by the Congress within the next few years to initiate Test Reform legislation just as it did with Procurement Reform.

The problem is not being addressed at the proper level within the Pentagon. To the contrary, I believe that the key players in the Pentagon have become more a part of the problem than the solution. People who are critical of certain tests are labeled whistleblowers, are transferred or reprimanded and quickly become persona non grata. There are many examples.

The Congress in Public Law 98-94 required the establishment of the Office of the Director, Operational Test and Evaluation. I would respectfully request that you not mislead yourselves into believing that this organization will result in effective quality testing. Remember, it took over one year to select the Director and I would ask you to look at the organizational structure of this office. It is staffed by 17 individuals of which four are administrative with a total budget of under $12 million. It has responsibility for over 140 major acquisition systems--12 major systems per individual. You might ask how in heaven's name this Congress can be assured of effective testing under realistic conditions with such a small workforce.

Russ Murray, who was formerly the Assistant Secretary of Defense, is now a member of this committee's staff. In 1978, during his tenure as the Assistant Secretary, he was given the responsibility for operational test and evaluation. He was given a total of 11 people for this function. In a memorandum of July 22, 1978, to the Deputy Secretary of Defense, Russ called the situation a sham and advised that unless he got the proper workforce, he wanted relief of this responsibility. I have a copy of his memorandum, Mr. Chairman, which I would like to provide for the record.

Mr. Chairman, the situation is still very much the same in spite of Public Law 98-94. Regardless of how competent the existing director may be, I would postulate that the intent of the provision of law cannot be carried out with a 17 or 20 or even 30 man or woman workforce with a $12 million budget.

Having given my opinion about what is wrong with test and evaluation, I would like to talk briefly about a very good Defense Department initiative--that of Joint Live Fire Tests (JLFT). This concept was developed by Colonel Jim Burton who you will be hearing from later this afternoon. Colonel Burton had the idea to expose U. S. armor, ships, andaircraft to enemy munitions in order to assess our effectiveness. The JLFT would also assess the effectiveness of U. S. munitions against Soviet armor and aircraft. Unfortunately, Colonel Burton was unsuccessful in getting the Navy's concurrence in evaluating the survivability of our ships--something that I believe should have been done years ago.

The problem of vulnerability is not confined to the Bradley. We have ships in our fleet today that are vulnerable to the most simple kind of munitions. We have used aluminum in our superstructures and everyone knows that aluminum spalls and burns. We have not provided adequate protection to our waveguides and in executive session I could give you the most startling results of tests that clearly point out the vulnerability of some of our combatant ships. The sad part about this is that we can greatly enhance the survivability of our platforms for a very modest investment. I should also point out that the Navy has paid very strict attention to ensuring the survivability of the new DDG-51 Arleigh Burke class destroyer. It is the best engineerng and architectural effort--in my opinion--since the design of the battleships.

Returning to the subject of the JLFT, I would add that it is only because of this concept that we can identify problems with the Divad, the Bradley, F-16's, F-18's, and other major weapons systems.

The problem with the JLFT is not with the concept but with the implementation. The service input and influence is still very strong as is evidenced by the Bradley tests.

If you share my positive opinion about the JLFT concept, then I would strongly recommend that the fiscal year 1987 authorization bill contain a provision requiring the JLFT because, Mr. Chairman, I believe this whole episode over the Bradley threatens the very existence of this valuable test procedure.

The History of the Bradley or How Not to Develop a Weapons System

I would like to turn now to the issue of the Bradley and show how a system that spends 17 years of its life in research and development can become so controversial.

In the normal development process, a service should start out with a stated requirement for a weapons system. Performance thresholds are established in what is called a Development Concept Paper (DCP). In the case of a missile, for example, the altitude region in which the missile was to perform would be stated with a margin on both the low and the high side. Similarly, the launch envelope would be specified as well as the target characteristics. During the development phase, a program manager would be satisfied if the tests indicated that the missile could perform in accordance with the DCP and if things did not go too well, hope that it would not breach the thresholds.

The same approach would be used for the development of an aircraft, a tank, an armored personnel carrier or any other weapon system. The Bradley Fighting Vehicle and a host of other weapons systems did not follow this strategy.

The concept of the Bradley started over two decades ago, but in the formal sense, began in 1964. There was a joint U. S.-Federal Republic of Germany study in 1964 that established the requirement for the Mechanized Infantry to be able to fight from a vehicle--mounted. In 1965, after approving this study, the Army initiated the Mechanized Infantry Combat Vehicle--the MICV--which ultimately became the Bradley.

It should be emphasized that the Army's concept at that time was to develop a relatively simple follow-on to the M-113. Within a few years, however, this simple follow-on was becoming more complex. In 1968, the Army Vice Chief, General Ralph Haines, rejected the design proposal because the proposed vehicle was too big, too heavy, and too complicated.

Later in 1968, a panel was convened under the direction of General George Casey to review the design of the MICV. It is my understanding that General Haines believed that the principal function of the MICV was a transport and not for anti-vehicle applications. The Casey Board presented its findings later in 1968 and recommended a low-cost, small light vehicle--much different than the one proposed by the Army's Combat Development Command. Toward the end of 1968, General Palmer, who was then the Vice Chief of Staff, approved the MICV proposed by the Casey Panel. This smaller, simpler vehicle would carry a crew of 12 with a stabilized cannon and firing ports for the infantrymen.

This was, in my opinion, the epoch for the ensuing controversy, conflict, disruptions and perturbations in the MICV program. On the one hand, some of the Army wanted a transport vehicle--a battlefield taxi--with an anti-personnel capability. There were others, however, who wanted more than an anti-personnel capability, and in my judgement, the Casey Board provided a compromise by adding a stabilized cannon to a light, simple low-cost vehicle. The estimated cost of this vehicle was about $115,000 and its weight would be somewhere around 35,000 pounds.

It was in 1969 when the Army began talking about the MICV as a companion vehicle to the new main battle tank, the MBT-70. The controversy and conflict was beginning to heighten. Again, people in the Army and in the OSD questioned the requirement and configuration of the MICV. At that time there was still another study to evaluate an austere MICV. This vehicle would use a Sheridan power train, a simple pedestal mounted cannon and Sheridan suspension. This austere vehicle was shown to be nearly as effective as the MICV and in 1970, the Army approved the development of the austere MICV. The Deputy Secretary of Defense approved the Development Concept Paper in 1972 but again, within one year, the simple cannon was abandoned, the complicated Bushmaster gun was added and austerity rapidly became history.

In the post-1972 era, the MICV was showing rather poorly. Its weight was over 42,000 pounds, it had power train problems and collectively the problems led to a GAO report that was critical of the MICV in 1974.

An event that significantly perturbed the MICV program was still another change in its mission. In 1974, the Army terminated the Armored Reconnaissance Scout Vehicle program (ARSV). The MICV was now identified as the replacement for the ARSV and now we had what I considered to be an anti-personnel, anti-vehicle, scout platform all of which would lead to a vehicle that did a lot of things very poorly rather than a single mission very well.

In 1976, after Secretary of Defense Schlesinger threatened to terminate the program because it was too expensive for the capability that it would provide, the Army conducted a study to put the TOW missile on the MICV. The need for the MICV was now being questioned by Army Secretary Hoffman which led to a study chaired by General Richard Larkin. The Larkin Panel recommended the development of a two-man turret. The conflict was reaching its pinnacle since the two-man turret now resulted in a vehicle that could carry not the 12 men recommended by the Casey Board, or the 11 men approved by the Deputy Secretary of Defense in 1972, but 9 men.

This was significant since we now had a 9-man vehicle of which three of the crew were dedicated to and would have to remain with the vehicle. It was significant because in 1978 the Army Infantry School conducted a study to evaluate the effectiveness of a 9, 7, and 5 man squad. The results of this showed that a five-man squad was less than 20 percent as effective as a nine-man squad. Since three men were dedicated to the vehicle, we now had a six-man squad which was deemed ineffective by the Army's own studies.

While it's true that studies can be in error, the results of this particular study were actually verified in operational tests at Fort Carson, Colorado, between the period July-November 1979. I would also point out that the Army Chief of Staff advised the Congress in 1980 that if the MICV were to be designed in 1980, he would want it to carry more infantry.

Mr. Chairman, members of the subcommittee, the Bradley Fighting Vehicle development program is a textbook example of how not to build a weapons system. If you review the history very carefully and in great detail, you could come to the conclusion that we have built an "operational kludge." The issue before you is really WHAT IS THE BRADLEY FIGHTING VEHICLE SUPPOSE TO DO?

If it is to be used by the infantry on the defense, you have to carefully analyze the test results to determine if it can survive enemy weapons. My review of the data, albeit cursory, tells me that this vehicle cannot fight side-by-side with tanks.

If it is to be used on offense, is the visibility of the crew such that it can see dug-in enemy troops? Additionally, how can the Army explain the loss of effectiveness as a consequence of the six-man dismounted squad?

Mr. Chairman, my brief review of the test results brings me to the conclusion that very little has been done to demonstrate the effectiveness and survivability of the Bradley. Some examples--the impact points and attack directions of the live fire shots were not random or representative of the locations of combat impacts. Ammunition in the Bradley contained inert fuzes which did not demonstrate the violence of the reactions of ammunition that takes on a direct hit.

My brief review of the test results generates more questions than answers. There is a need to do more dynamic testing. There is a need to use live fuzes in evaluating the violence of ammunition strikes. We cannot fault the JLFT concept for these deficiencies. In fact, without the JLFT, the problems would never have surfaced. You might question the Army representatives who delineated the test plan why the testing was structured in such an unrealistic manner.

In all candor I could not give you a favorable recommendation on the basis of the tests conducted to date. So much more has to be done. The Procurement Subcommittee will conduct a more comprehensive review of the program and the test data.

Based on this review, there may be less costly, more effective alternatives to the Bradley. These alternatives would include the improved M-113 used by the Dutch--the XM-765.

Anti-Armor Deficiencies

There is one final matter that you asked I discuss--the anti-armor capability of our infantrymen. Perhaps you have all seen the article. Perhaps you have all seen the article in the Washington Post of January 13, 1986, concerning the needs of the infantry soldier for better anti-armor weapons.

Mr. Chairman, I believe that the article is entirely accurate. In World War II German tanks ran over our infantry while our bazookas bounced off of them. In Korea, our bazookas bounced off of T-34's. Comparatively speaking, we are no better off today than we were in 1943 and it is a sad situation because not only have we spent hundreds of millions of dollars developing systems that were not fielded or were ineffective but we have really slighted the infantry soldier. Today, we have the Light Anti-Armor Weapon--the LAW--and it cannot penetrate the targets of interest. We have the TOW which exposes the soldier and is running out of capability. We have the Dragon which in its present state is effective against a target that might inadvertently run into the missile. We owe our combat forces far more anti-armor capability than we have given them. The history books and those who have seen combat should confirm my opinion. It is indeed unfortunate that the whole anti-armor issue has been wrapped up in bureaucratic ricebowls and the losers are the infantrymen and the taxpayer. I would strongly urge the subcommittee to develop this issue with Army representatives during the fiscal year 1987 budget review.

Summary

Mr. Chairman, members of the subcommittee, I thank you for asking me to present my views on Department of Defense testing, the Bradley and anti-armor.

It was not my intention to embarass the Department of Defense, the services, or any individual in the Pentagon. I have called the situation as I see it. There are many good test programs conducted by honest objective people in the Department of Defense. As I stated earlier, however, each year the number of success-oriented unrealistic tests increase and the Congress is not getting the right story. Most unfortunately, however, is that our combat forces are not getting the systems that they need to carry out their mission. Mr. Chairman, if there was only one system in the Department of Defense that was not properly tested it would be one too many. So much depends on the system performing in the manner in which the requirement was written and the combat troops expect.

I believe that the Congress is being slow-rolled on Public Law 98-94 and that the Congress must insist on quality testing and the need to continue and expand the Joint Live Fire Test program. Military and civilian personnel who insist on quality testing should be commended rather than reprimanded.

There can be no question that complete testing of any weapons system is impossible and impractical. Through common sense and good judgement a system can be tested at the extremes of its envelope in a realistic environment in a way that is affordable to the taxpayer and in a way that gives high confidence to our combat forces that the weapons that the Congress has appropriated and that the Department of Defense has ordered will do the job that he or she expects.

Mr. Chairman, this completes my statement and I am prepared to address any questions that the members may have. Thank you.

Mr. STRATTON. Mr. Chairman, is the witness talking about the quality and the concept of the Bradley or is he talking about testing? I have not heard anything about testing for the last 10 minutes.

Mr. BATTISTA. No, Mr. Stratton. What I am talking about is the history of the Bradley, to show how its mission has been changed repeatedly for the past 22-year period. On the testing issue, it is my understanding that your subcommittee is going to get into that on February 18. We have not gotten into the testing data per se other than a quick cursory look. I would be prepared to offer you my comments on the testing, but they are very, very brief.

Mr. STRATTON. I thought the point of these hearings was with regard to testing.

Mr. BATTISTA. That is correct.

Mr. STRATTON. The question of whether the Bradley is adequate to its mission or exactly what the mission is is what our committee is going to be looking into.

Mr. BATTISTA. Yes, that is correct, Mr. Stratton.

Mr. STRATTON. I think that all of the slides that you have had for the last two or three are all negative in connection with the Bradley.

Mr. BATTISTA. No, it is intended to be negative as far as an acquisition strategy for any system, including the Bradley.

Mr. STRATTON. Yes, but the R&D Subcommittee is not dealing with acquisition strategy. We are the ones that are going to determine whether we are going to have the vehicle or not.

Mr. BATTISTA. No, Mr. Stratton, the mission of the R&D Subcommittee is to establish the validity of requirements before we embark upon the development, to make sure that we are indeed choosing the proper course of action.

For example, if you need a new air defense system, can you improve Chaparral to meet the requirement or do you need a new one? In that vein, the R&D Subcommittee is concerned with acquisition strategy, and a review of the hearings for the past two decades would indicate that that is the case. People do look at the requirements to establish whether or not the Pentagon is choosing the most cost-effective solution to the problem.

Now, my main message here is I do not care if it is a Bradley or a ship or an airplane. If you are going to develop a system, do not keep it in development for 17 years where it is subjected to a lot of perturbation. You cannot interpret the Bradley test results until you know what the mission of the vehicle really is. So that is my message.

CONCLUSIONS ON BRADLEY TESTING

Tests were deficient.
The BFV can be "blown away" but so can the M-113, the M-114, the BMP.
The mission of the BFV is unclear.

I will talk a little bit about the testing. It was a very cursory look, but the tests were deficient. There is a lot more to be done. The mission of the Bradley fighting vehicle is unclear. Therefore, I am in no position to suggest to you that you continue buying it or cancel it or anything of the sort. All I am suggesting to you is that for future weapons system development you not follow the history of the Bradley, and that much more has to be done if you are going to establish the effectiveness of the Bradley.

OBJECTIVE: DETERMINE SURVIVABILITY OF BRADLEY ON BATTLEFIELD

What is operational concept for Bradley?
Establish validity of live-fire tests.
Examine test results in terms of operational concept.
Compare Bradley to existing M-113 carrier.

As I said earlier, that is not within our purview. That is the Procurement Subcommittee's jurisdiction. And, by the way, this is what the Procurement Subcommittee, I am told from the staff over there, plans on doing, beginning February 18. You are going to look at the operational concept of the Bradley; you are going to establish the validity of these tests; you are going to examine these tests and compare the Bradley to other vehicles.

All I am giving you here today is the chronology of the program, so that you can, in fact, establish what the operational concept for the Bradley really is. I am not trying to preempt the Procurement Subcommittee, Mr. Chairman. You didn't ask me to do that. I have responded to the guidance that you did give me.

Mr. **HERTEL**. Mr. Chairman, as I understand it, we have been talking about today and before how to improve the system. You have been talking about the Bradley as an example——

Mr. **BATTISTA**. As an example.

Mr. **HERTEL** [continuing]. Of what the mission is and then the changes that are made along in the mission.

QUESTION

Does the Bradley do too many things poorly?
How will it be employed?
Are there less costly, more effective alternatives—the Dutch 765 (improved M-113).

Mr. **BATTISTA**. That is correct.

Mr. **Hertel**. What it is used for and, therefore, in the design in major ways that then set off other cost increases and, very frankly, delay is what you show most clearly on getting something into the field. Do you have some summary for us as to what might be tried? You are aware that the House passed the authorization, an amendment to have the GAO study a civilian procurement agency. It would be more than that; it would be testing, et cetera, but only after the branches of the military made their requirements to this agency. All the other countries in the world have such an agency to carry on with the production and competitiveness and testing and design. In the entire world I think there are only a few smaller countries—Norway is one—that do not have civilians, and in that regard we are asking the GAO to study, to report back to us on it.

What are the problems in changing the system? What do we have to watch out for? But, mainly, how do we finally say this is what we want, this is what we need and go ahead with it so we get it out in the field rather than have these changes that take years and decades that you have given.

Can you comment on that, on solutions?

Mr. **Battista**. Well, yes; I hate to take us back in time, but there are points in our lives where it is best to go back in time. Go back to the fifties when you did not have 30,000 people in the Pentagon or whatever the number is today, all representing a no switch on a particular program, where you had the Congress, you had the military and you had the OSD civilian components working in harmony to the extent that if you wanted to develop and deploy a system—and I will give you some examples, Nike Ajax, it was 2 years to develop and they began production in 2 years and 6 months. The Hawk, that was a really classic example at the time of how not to do a system, because it took 5 years to get there.

Well, you know, I think the program, the average program manager today would think he died and went to heaven if he could have a 5-year development on a weapons system. The fact of the matter is we have got just too darn many players, and I am not going to exclude congressional staff, myself included, in the development business; and what is happening is we spend years and years talking about requirements, and then when we get somewhere, get to the point where we are ready for testing, the testing is success oriented and really the system is performance on the decline.

Mr. **Hertel**. What we are seeing through this example and others—and there is no evil intent obviously on the part of the people that are involved in making the changes in the mission, no evil intent by people that are doing this. They are looking for what they think is the best way to go, the best thing to do for a given weapons system. The fact is there are a lot of players involved and a lot of changing players that make judgments at a later time after we go down one road, then we want to make a left and a right turn to add different requirements. So you are telling us really we should go back to a simpler time when we do not keep developing and developing and changing, and we make a decision, not only the military, not only the Pentagon, the Congress too.

Mr. **Battista**. That is correct.

Mr. HERTEL. We make a decision on a direction and stay with it for a shorter period and spending less money to get an actual result in the field.

Mr. BATTISTA. I have said on a number of occasions, Mr. Hertel, I think very often Congress is more of a part of the problem than a solution. I think in testing today key leaders in the Pentagon are in many cases more a part of the problem than a solution. I think if you go back over the Bradley history you will count no less than 500 names who perturbed that program along the way. The fact of the matter is Congress and the OSD have to sit down and say, look, what is your requirement. We agree to this. OK, let's go build it.

Mr. HERTEL. You say we need a different system to do that.

Mr. BATTISTA. Absolutely.

Mr. HERTEL. A different process in the Pentagon, but a different process in the Congress.

Mr. BATTISTA. That is correct. But right now look at the number of committees on Capitol Hill that a weapons system is scrutinized by, all under the guise of legislative oversight; and, you know, I have said on a number of occasions Washington, and especially Capitol Hill, is non-Newtonian. For every action there is not a corresponding reaction but an overreaction.

Everybody wants to solve the problem and everybody is well intended, but the fact of the matter is we have got so much legislation—and I am not getting into procurement reform right now—but so many artificial widgets and so much paperwork required on the part of the development process. If I were to describe to you the acquisition process today, I could not do it on a chart smaller than 33 feet long. I showed that chart to the R&D Subcommittee. Twenty years ago the chart was about 3 feet long.

Mr. HERTEL. In the Congress we are dealing with a total authorization on a yearly basis, having the debate in the House and then having so much coming up in conference, so many different issues coming up, I think it might be better if we on our part broke things down more, not only in our subcommittees but in passing things through the entire Congress so that they will get mixed up in apples and/or oranges in the conference, when they cannot be discussed as separate ideas and items in needs and requirements.

Mr. BATTISTA. Yes; I think you know it is something that has to be done if we are going to get a better return on investment out of the Department of Defense, but I will tell you, Mr. Hertel, as long as you have 42 discrete imagery programs, 18 millimeter wave guidance contracts in the same two frequency bands, as long as you have got five different systems to communicate with tactical aircraft, you are not getting a good return on investment. Unfortunately, everybody talks about the defense budget in terms of how much growth next year. That is not the main issue. The main issue is how the money is going to be spent not how much.

Let's look at last year. The Navy had a JTIDS, Joint Tactical Information Distribution System, to communicate with ships and airplanes. They had a D version. The Air Force has a TDMA, Time Diversion Multiplex Access, a T version. The Navy was going to get sea control support from the Air Force; yet they had two different systems to communicate with. That is not the end of it.

We had a Have Quick system too, and, by the way, the Air Force said JTIDS is not good enough, so we need an enhanced JTIDS. That is four already. Then you have a fifth one coming along called Integrated Communication Navigation Identification Avionics System [ICNIA].

OK, that is five different systems to communicate with aircraft. You want to look at electronic warfare. It is very effective in terms of multiplying your force effectiveness; yet an F-15 has an ALQ 135 and the F-14 has an ALQ 126, and the F-111 will has currently the 137 and may have an ASPJ or 189, and the F-16 has ALQ 131 pods in addition to ASPJ's that may be coming on line.

Mr. Hertel, I can count for you probably 2 dozen radar warning receiver and jamming systems for different airplanes that are subject to the same threat spectrum. Who needs that? You have got 26 discrete, at my last count, inertial navigation systems in tactical Air Force fighter aircraft, all spec'ed to the same number of nautical miles.

Think of the logistics tail that you get.

So the real issue is not how much we are going to spend on defense next year, but, Mr. Secretary, how are you spending it?

Mr. **Dickinson**. In line with what you are saying, I was wondering, can our aircraft talk to each other, the Army, Navy, Air Force? Can they talk to the ground yet?

Mr. **Battista**. In most cases, Mr. Dickinson, through brute force. Remember the situation when you asked the Navy and Air Force if they planned on going to different wars together. The Air Force said, yes, we can talk to Navy ships. Yes, that is correct, if you send AWACS out there with the guy. That is what you really want to do? The answer is yes, but not very effectively.

The situation has gotten better under this administration in command control and communications, but we are still wasting a lot of money. We are not still getting there from here.

Mr. **Dickinson**. General Hollingsworth, you have lived through all this we are talking about.

General **Hollingsworth**. Thirty-six years worth.

Mr. **Dickinson**. Do you agree with what Mr. Battista is saying and do you have anything you could add to it? Really, communication is so important, and we are spending millions of dollars and they cannot talk to each other, plus NATO, that is different.

Now, you made a comprehensive study of our capability in NATO. If I am not coming in late, and you have already spoken to this, what can you add to what Mr. Battista is saying?

STATEMENT OF GEN. JAMES HOLLINGSWORTH, U.S. ARMY (RET.)

General **Hollingsworth**. Let me reflect back to some very early experiences in my lifetime in the military during the African campaign. We went to Sicily, and the Navy shot down General Gavin's regimental airborne team that was going to land in front of us, and we finally got ashore despite our P-38's belonging to the Air Corps. That is the basis for the Air Force today, and it has not improved a tremendous lot. Some, I would say, but the communications were so well that we had to fire on them to keep the P-38's from killing us on the beach.

Mr. Dickinson. Say that again.

General Hollingsworth. The P–38's were firing and bombing us on the beach in Gala. The communications were so well we had to fire on them in order to get them away from us. So communications really represents a problem, and I think that you have heard a lot of stories about the Grenada operation and this committee is familiar with that.

I would like to say that this situation has been a troublesome problem throughout the 36 years that I was allowed to stay in the military, and I think that when we started talking about interoperability of equipment in Europe a few days ago, Mr. Dickinson, that we were talking about a German unit on our left talking to an American unit on its right and vice-versa.

I doubt if that can be done today with any degree of satisfaction when you slip in the Belgiums and the French and the Dutch, and it represents one of the most serious problems that confronts any force in battle—communications. And it is a costly, never-ending task, and I do not know that there is a real true answer to the problems of communications on the battlefield.

What is very disturbing to me, during the Vietnam conflict, in the way of communications was running a war on a peacetime basis with a limited number of frequencies for each of the combat divisions and other units in the theater, and at the same time running all the commercial nets that were required for a host nation.

I remember distinctly one time in contact on the Cambodian border I learned that day that a division along the DMZ some 200 or 300 miles north was on the same division command frequencies that I happened to be on, and it could have caused a very devastating afternoon if I had not used bad language to everybody there, which I normally do not use at all. But on this particular occasion it was necessary in order to get these people off the net and somebody do anything about it.

Mr. Dickinson. I went to the same Sunday school class you did, General.

General Hollingsworth. So it is a real problem. I think you will find in the Army today, out in the units—I happened to be on maneuvers last week with the Army. I went out on my own at my own expense, but I met some of my youngsters that I have trained along the way. One of them that I met out there in the weeds was a General Burba. His dad was a distinguished general in World War II and he now runs an infantry training center.

I found him under some bushes looking at the Bradley Fighting Vehicle, and we got a pretty good view of where we are on that, Mr. Bennett, and I do not want to avoid further communication questions, but I found a communication there that needs upgrading very badly, and it is in the military.

But if you come over here and ask for $250 million and somebody gives you $150 million or somebody gives you $300 million, that does not necessarily mean that that gets equipment out in the hands of the troops. And there is a reason for some of these long delays in that regard, from a standpoint of R&D.

We do not build seven different models of the tank, as the Soviets have done since we started the M–1 tank which was M–60 and

MBT-60, and then we got McNamara. You remember him, don't you, sir?

Mr. DICKINSON. I remember him pretty good, General.

General HOLLINGSWORTH. Yes.

Mr. DICKINSON. I do not think this one will ever get over him.

General HOLLINGSWORTH. Anyway, there have been many models of—the Soviets have been putting many models in the field, and you have to take a wild judgment on whether or not you want to stop a vehicle and throw it away or delay it and add technology and whether you save money by doing that or whether you should have gone ahead and put that particular piece of equipment in the field and started all over. That is what the Soviets have been doing. I do not know. I think that is a judgment that has to be made in the Halls of this Congress and also with the executive branch of our Government. It is my belief that this is the reason for 20 years to get the M-1 tank on the road, the infantry fighting vehicle on the road, and I want to say, Mr. Bennett, in that regard that history is one thing and I do not intend to repeat it.

My distinguished friend here on my left, that we worked together for many years, has given you the story of that. It is in the field. It is in the hands of the troops. It does not go chasing off across the battlefield. It did not need any testing by firing missiles at it because if you have ever been in combat, leading light armored forces across Africa and Sicily into the occupation of Berlin as a tank commander and armored infantry commander, you would not need to test that to know that it is vulnerable, and it is the same way of the F-15 and the F-16 taking off the ends of the runway with a guy laying an SA-7 to it. It is very, very vulnerable. The B-52 is vulnerable. The B-1 is going to be vulnerable to the SA-5. They are going to be blown away.

Very few vehicles, gentlemen, on the battlefield that do not have vulnerability. It is a matter of leadership and how to deploy these systems that you provide us. We do the very best that we can.

Now, to say that the Bradley fighting vehicle is the ultimate, far be it for me to say that because it is not. There is a lot of work going on now to try to take advantage of what we have learned from this period of time that we have gone through with breakthroughs in technology. You distinguished gentlemen have sat here hour after hour and agonized over and provided us money to do these technologies; they are coming to fruition, and I think that we can learn something by doing some block modernization. The Soviets do it every 4 years. I reckon we really have not gotten around to doing it every 5 or 6 years; but I think if we started looking at the vehicles that we have got right now and started improving them and as a result of these improvements and technologies that are available to us, we are going to go a long way to always maintaining a credible conventional deterence because we have got the people, we have got the know-how.

I met some of the finest soldiers that I have ever seen in anybody's army. I have seen a lot of armies other than our own. We have a bunch of them back here. I brought some of them out that were on that maneuver with me, and they will be glad to tell you what they can do to that vehicle, but the Bradley was not designed to go chase T-72's and T-80's and that sort of thing. It has got a bad name. In the first place, it is not in my view a fighting vehicle. It is an infantry support vehicle. I might even use it to haul casualties sometime. I might even use it to haul supplies and ammunition. I might even not use it at all on some occasions and put everybody on the back of it, on top of the tank, or make them walk along beside of it, and I might have somebody bring it up to me when I needed it.

So it does not mean that we are going to take this thing and chase, like you see in the Army's tank advertisement, for recruits this day and time, Mr. Dickinson. I do not know whether you are behind that or not, but you being a great supporter of the Army, as all of you have been, where this tank is sitting there listening, all at once a radio clicks on and the lights turn and they crank up this M-1 tank and they jump a channel about 50 yards wide, then they go chase this enemy tank and they kill him.

Well, please do not believe any of that. We do not do it that way in battle. What we do do though, to close off 14 German divisions during the 1944 period at the Ruhr pocket, you take the Second Armored Division, led by Hollingsworth's task force of a tank battalion, two armored infantry companies and an artillery battalion, and you take the Third Armored Division down at Cologne and you close off in 5 days and 5 nights 14 divisions in the heart of Germany, and you do not stop for 5 days and nights and you have got to have people on the ground, in vehicles, keeping up, moving, fighting all night, some not moving at all, some armored personnel carriers and tank drivers back. You have to go back and wake them up, but this is how this thing goes.

And regardless of whether the Bradley is—I do not say it is the ultimate under any circumstances, but it is what we have got and if you wanted to go blow it away, if you needed to—I did not know we needed to blow it away—to find out it is vulnerable, I think the colonel and whoever his boss is in OSD who finally got around to blowing one up should be required to pay for that, maybe out of their own pocket, because all they needed to do was ask me about the vulnerability of any vehicle and I can tell you.

Mr. DICKINSON. I do not remember what the question was, but I thank you for the answer.

General HOLLINGSWORTH. You got the answer.

Mr. BENNETT. Could I inquire a little bit. I might suggest that Colonel Burton join the three witnesses today. We could interrogate all of them, three of them at once.

While you are thinking that over, in the first place, nobody ever thought that people in war were going to be invulnerable or any particular vehicle was going to be invulnerable. Of course, anything can be used, including a water buffalo or a rope or a lot of other things, to operate in time of combat. You use whatever you have available. That is not really the question.

The question here is about testing. We have had this testimony given us so far as to the great change in the nature of this vehicle time after time. Later on Colonel Burton can tell us about the change in tactics for the use of it. That does not necessarily mean any of this is wrong and nobody has suggested that these vehicles that are in existence should be scrapped or blown off the face of the Earth.

What I am inquiring about is what the tactics are, in fact, for this vehicle at this time. Now, of course, you want to say they could be slept on or eaten upon or have people sitting on top of them. You can do anything you want to with the facility, but there has to be a tactical reason to spend this kind of money and imperil the soldiers we are going to have in them. You have to have a tactical purpose. You set out when you spend hundreds of millions of dollars to have a purpose for it. I am not sure what the purpose is because I read a lot of paper about this, and a lot of people have different views as to what the tactical purposes of this vehicle are. I am sure you could use it for many things, including a dining room table, but that is not the purpose of this vehicle.

So I am inquiring about what tactics are designed to be accomplished by this particular vehicle, and then the other thing which I think is even more central to this matter, I would like to ask Mr. Battista about this for clarification, is as to the procedures this R&D Subcommittee once posted upon the Bradley in some form. A lot of changes have taken place as to the Bradley. Were each of those changes tested or each of those changes before this committee or did we turn loose a Bradley which has changed its nature in the Department of Defense without consulting this committee?

Mr. **Battista**. There was a lot of frustration back in 1977, 1978 when we held the hearings on it. My recommendation was to terminate it, because I thought it had been so hybridized, if I might use that term—that it couldn't meet the Army's old original Qualitative Material Requirement, but it did other things now.

Mr. **Bennett**. We passed on all those changes.

Mr. **Battista**. No, we did not. In fact, when the recommendation was not accepted, the R&D Subcommittee at that time proposed that we at least tell the Army to stop fooling around with the vehicle, and we mandated an initial operational capability date of 1981, December 30, I believe, 1981.

So we said, look, enough of this fooling around. Either build it or kill it. That was the situation on the Bradley, as it came out of the R&D Subcommittee.

Mr. **Bennett**. As it is now, it is a vehicle that has a lot of gasoline and a lot of ammunition and a very dangerous place for its personnel, and that is something, of course.

All soldiers are likely to be killed. We don't expect to make them more likely to be killed by faulty planning. We are not talking about a necessary heroism.

We are talking about unnecessary heroism. We are trying to see, too, if this function, if these tactics are the right tactics for the vehicle, and we are spending the right kind of money for it, then we expect people to be in danger. They will be fighting for our country.

You have told me, then, that we turned it loose, and the Department of Defense developed things without coming back to this committee for a consent by this committee to go forward with the change of this vehicle which is changing so dramatically. Is that the truth or not?

Mr. **Battista**. No, the truth is close to it. The truth was "Army you get out there by 1981, and whatever you decide to change do it now." So, in effect, they did come back. But, you know, this 34,000-pound vehicle is now a 50,000 pounds or thereabouts.

As I said, the nine-man squad became a six-man squad. There are a lot of things that happened. You know how the DOD witnesses come up and appeal to the subcommittee. The issue was thoroughly evaluated, and the decision was made, let's follow the Army's recommendation on this, and that is what happened.

Now, I would agree, in part, with General Hollingsworth's assessments that we don't have to do some of these tests. There are tests that you know, from an engineering perspective, are not worth doing. Some things are not survivable.

To blow the Bradley off the face of the Earth—we know we can do it. Don't waste money. I don't think Colonel Burton did that.

Mr. BENNETT. I would like to ask Colonel Burton or General Hollingsworth or somebody, what is this vehicle now supposed to do?

Just 1 second. Is it supposed to be forward of the tanks? Is it supposed to be behind the tanks? Because I have seen people that had different points of this view on this. It has a longer range than some of the tanks' weapons we have, and does that mean it is supposed to be behind?

I am not saying it couldn't, in a case of opportunity, be differently used, but I am talking about what is its ordinary procedure? Is the ordinary procedure to be behind the tanks or in front of them?

Mr. BATTISTA. I am going to defer to General Hollingsworth on that. Frankly, I have zero infantry and armor experience. I will say this is what you have to develop with the Army.

Colonel Burton couldn't give you this answer. I don't want to put words in his mouth. You have to establish with the Army what is the mission of this vehicle.

Mr. BENNETT. That is what I want to know.

Mr. BATTISTA. Then you can look at tests and say these tests are or are not meaningful.

Mr. BENNETT. That is exactly what I want to know.

General HOLLINGSWORTH. We have got a lot of people here from the Army that commands battalions right now. I think they can tell you the same, as I do, that in combat, that is what we train for, as you well know, tanks and infantry work together as a team supported by artillery.

Tanks support infantry when they are dismounted in combat, in towns and villages, and infantry supports tanks.

So, on any given day, the infantry may be on the ground in the forest and the vehicle in back.

Mr. BENNETT. I am an infantry soldier. I know everything you have said. I don't know, from what you are answering, what this particular vehicle is supposed to do with regard to that.

General HOLLINGSWORTH. This vehicle carries infantry soldiers, and in addition to that, it has a firepower killing capability that can support the tanks in many instances on its flanks and also on its rear.

Mr. BENNETT. You don't think it is forward of the tanks?

General HOLLINGSWORTH. Absolutely not, under no circumstances, unless they are just out of their minds.

Mr. BENNETT. That is what I am trying to find out.

General **Hollingsworth**. I had hoped, sir, that earlier on, when I said we don't have this light vehicle out chasing enemy tanks, that in order to do that you are going to have to get out in front of the real fighting vehicle which is the tank, and they just can't do that, sir.

Mr. **Battista**. Mr. Bennett, one other point I think you ought to ask—that is the mission that General Hollingsworth just established.

What about the Army's requirement to do it with nine men in view of the fact that now you have got six? I don't have the answer. What I am suggesting is these are the things you have to establish, and you probably are going to have one of the finest witnesses you can get in the Army in General Thurman who, I think, can address all of these issues.

That is what you have to look at before you look at test results. By the way, I am a strong advocate of these joint live-fire tests, not to blow something away but to establish how not to use something or ways to enhance your capability.

We shouldn't lose the combat capability of a ship because a bomb goes off just a few hundred feet away from the ship. We shouldn't have to lock the emergency breakers.

Mrs. Holt, we were on a trip, and we were in the ward room of a particular ship—I am not going to comment in open session—when I asked the captain of that ship, "How about your vulnerability?"

He said, "It is great."

I said, "How about the episode when you had your concussion grenades going off over the side?"

He said, "You heard about that."

Do you remember that, Mrs. Holt?

We have got other problems. They are not only with Army systems.

Mr. **Bennett**. Ships that had aluminum superstructure and all burned, anyway. We learned that in actual experience.

Mr. **Battista**. You see, Mr. Bennett, everybody knows that aluminum burns. You don't want to put it in the superstructure. I will say one thing. The DDG-51—this is the best architecture and engineering effort I have seen since the days of battleship. The *Arleigh Burke*-class destroyer will be a most survivable ship against the current generation of Soviet weaponry. It is a good platform. They did a fine job. I think the Secretary ought to be commended on that.

But, this committee did a lot of insisting and arguing before we got to that point. I might, Mr. Bennett, like to take 30 seconds to finish up, because the time of the afternoon is getting on, and we have Colonel Burton and General Thurman.

ANTI ARMOR CAPABILITY

- U.S. IS NO BETTER OFF TODAY THAN IN 1943
- WASHINGTON POST ARTICLE OF JAN 13, 1986
- KOREA – BAZOOKAS BOUNCED OFF OF T–34'S
- WW II – SAME EXPERIENCE
- TODAY – TOW, LAW, DRAGON
  - TOW – ✓
  - LAW – DEFICIENT
  - DRAGON – VIRTUALLY USELESS

You asked I comment on the article that appeared in the Washington Post, and again, I have to give you a depressing story. I don't think the Army today is any better off in terms of antiarmor capability for the infantrymen than it was in World War II or Korea or when we had bazookas bouncing off the T-34's.

I think it is a sad state of affairs we have—a TOW, a LAW, a Dragon. TOW is pretty good. LAW has problems. The Dragon—in the target, inadvertently it will get a hit, but I have got reports here 17 out of 18 missed the target. It is not a very good weapon, and we owe the combat forces a heck of a lot more than we have been giving them in terms of antiarmor.

So, my quick response to your question, I believe that article is absolutely accurate, and I think you ought to pursue with General Thurman and the rest of the Army what they are going to do to give the infantryman out there more antiarmor capability that works substantially.

Conclusions on Testing

There are many good test programs conducted by honest, objective people in the DOD but;

Each year the number of success oriented unrealistic tests increases and the data misrepresented to the Congress.

Congress is being stonewalled on PL 98-94: DOT&E has a 16 man staff; an $11 million budget; responsibility for 140 major acquisitions.

We need quality, not quantity testing.

Objective military/civilian testers become persona non grata.

And finally, my last comment is on the conclusions on testing. You have got to do something else, because you are not getting what you think you are getting in terms of 9894. You can't do this function with a 16-, 17-man staff, $11 million budget for 140 systems.

You have got to have quality, not quantity, testing, and those who step forward and say, "This thing wasn't tested right," shouldn't be reprimanded, because we owe an explanation to those guys in the field—hey, this is the way it works. This is the way it doesn't work. You can kid the Congress, but when the poor guy has to go out and use it, it better do that. It better do that, or we better tell him, "Look, it doesn't work against maneuvering targets."

I think that these guys have to, increasingly, in many cases, find out on their own. So, the bottom line is pay attention to how we are spending money in defense. You are going to need test reform legislation unlesss you can work out an agreement with Dr. Hicks, with the new Director of Operational Test. You are going to have to work these things out, because if you don't, we are going to continue to get a very poor return on our defense investment.

I think you are going to have more and more congressional committees saying, "What is going on here? Why do they have these things that don't work?"

And believe me, there are a lot of things out there that don't work that can be made to work with a very modest investment or things that don't work the way we expect, but they are still the best buy in town.

The important thing is that we have got candor with the Department of Defense and the service, and with the Department of Defense and the Congress.

I think that candor has been lacking. I think the Department of Defense owes you, as elected officials of your constituents, an explanation on why things work or why things don't work. You haven't been getting it.

That concludes my statement, Mr. Chairman.

General HOLLINGSWORTH. I have one final remark here I would like to make. That is that it is always a great pleasure for me to be here with you, yet, I am also standing by to do whatever I can to assist in being the credible conventional deterrent, and I think in support of my friend here, Tony, that my recommendation after looking at this thing for a long time on tests and evaluations, if you want a straightforward, correct, no-nonsense, unbiased answer on testing things, you had better get out of the middle, out of the Department of Defense and go set yourself up an independent operation somewhere that is not going to be bamboozled by a green, white, or blue suitor or a group of civilians that make a lifestyle and a long career off interbreeding among themselves in doing that kind of job.

Thank you.

Mr. PRICE. Mr. Dickinson.

Mr. DICKINSON. No, Mr. Chairman.

Mr. PRICE. Next is Col. James G. Burton, U.S. Air Force.

STATEMENT OF COL. JAMES G. BURTON, USAF, MILITARY STAFF ASSISTANT, DEFENSE TEST AND EVALUATION, OFFICE OF THE SECRETARY OF DEFENSE

Colonel Burton. Thank you for the opportunity to address this committee and explain the joint live-fire program. I have a prepared statement which I would like to have entered into the record, and a briefing which follows.

Mr. Price. You may insert your full statement in the record.

Colonel Burton. Thank you, sir.

PURPOSE OF JOINT LIVE FIRE TEST PROGRAM

SAVE U.S. LIVES BY TESTING TO ENSURE:

I. THAT U.S. WEAPONS PLATFORMS DO NOT UNNECESSARILY ENDANGER THEIR CREWS.

II. THE WEAPONS U.S. SERVICEMENT FIRE ACTUALLY STOP THE ENEMY.

THIS PROGRAM AFFECTS THE LIVES OF ABOUT 300,000 SERVICEMEN IN COMBAT

The joint live-fire test program is a formal, joint test that was initiated by OSD in the spring of 1984. The purpose of this test is as shown here, to save U.S. lives by testing to ensure that the U.S. weapon platforms do not unnecessarily endanger crewmembers and that the weapons U.S. servicemen fire actually can stop the enemy.

It is a two-sided test. U.S. weapons against enemy vehicles, enemy weapons against U.S. vehicles. The program itself affects the lives of about 300,000 servicemen who may have to use this equipment.

WHY IS THE JOINT LIVE-FIRE TEST PROGRAM NEEDED?

- o THERE HAS NEVER BEEN A PROGRAM TO SHOOT REAL SOVIET WEAPONS AT REAL COMBAT-LOADED U.S. VEHICLES AND AIRCRAFT (NOR VICE VERSA)..
- o SOME CONSEQUENCES:
  - oo IN WWII, KOREA AND VIETNAM, U.S. "BAZOOKAS" FAILED TO STOP ENEMY TANKS.
  - oo IN WWII, KOREA AND ISRAEL, U.S. TANKS PROVED EXCESSIVELY FLAMMABLE/VULNERABLE.
  - oo IN VIETNAM, U.S. FIGHTERS PROVED UNNECESSARILY FLAMMABLE/VULNERABLE.

WE HAVE NO IDEA WHETHER TODAY'S "BAZOOKA," TANK OR FIRST LINE FIGHTERS HAVE IMPROVED THIS SITUATION.

Why is it needed?

There has never been a program like this to shoot real Russian weapons at real targets configured as they are in combat with all the dangerous elements that are normally there: fuel, ammunition, hydraulic fluid.

We attempted a program similar to this some 10 or 12 years ago in the testing of F-4's, A-7's, and UH-60's after the Southeast Asia war. Because of flammability problems and vulnerability problems in that war, in 60 percent of the aircraft that were downed, fire and explosion were present.

During the war, kits had to be hastely developed to improve the vulnerability of those aircraft, so immediately after that war, there was an attempt to conduct a program similar to the joint live-fire program in the aircraft arena.

There was a fairly good evaluation of the F-4 aircraft, a less focused effort on the other aircraft. So, there is some precedent for this kind of a program, but there has never been a formal program like this in the armored area or the ship area.

As a consequence of not conducting live-fire tests against the equipment, we really don't know what kind of equipment we have. We don't know what the strengths and weaknesses are. There are a lot of expert opinions. There are many accounts through history on the failings of some of our equipment, because it was not adequately tested.

I invite you to read General Gavin's book, "On to Berlin," and the stories about the bazookas during World War II, Korea, and the Middle East. The flammability of the tanks was a painful experience for the Israelis in 1973.

After the 1973 war, many modifications were made of their M-60's, which had burned or blew up twice as often when hit as the British Centurions and more often when hit than the M-48's. This was a painful experience for them in terms of casualties.

As I said before, our own U.S. fighters were very, very flammable and vulnerable in Southeast Asia. By not conducting live-fire testing, real weapons against real vehicles, we really don't know whether or not today's bazooka, aircraft, or tank has improved in any way.

Mr. DICKINSON. May I ask a question at this particular point? Colonel Burton, I have asked this question, I don't know how many times of Army experts, tank experts, and so forth.

We had learned in the 6-day war in Israel that the Israelis could come around behind the APC's, the Soviet-built APC's, and shoot from the rear, and they stored gasoline or diesel, whatever, in the back ramp.

They closed up. It was very vulnerable there. If they shot from the rear, it would ignite and burn, so they would let it go by and shoot it from the rear. They had very high kill rate, and I have asked any number of times why we don't at least have auxiliary tanks on our gasoline or fuel tanks, on our APC's, but particularly our M-1's or other tanks, that can be jettisoned, just as aircraft jettison their tanks.

You use them. You get into a combat situation. You get into a situation of peril. You simply pull the switch, and jettison. You don't have to worry them about being ignited, and you have already topped off. You have a full quota there.

Now, can you tell me, is there a reasonable explanation why the U.S. Army doesn't use such a system? The Soviets do. They carry auxiliary tanks on the back of their tanks, fuel tanks on the back of their tanks.

What possible explanation is there, what rationale can there be that we wouldn't use this as an auxiliary tank that could be jettisoned when you get into a situation of peril? And then you have got just as much security as you would have, and you are already topped off. You don't have to worry about depleting your gasoline or diesel stores.

Could you give me some rationale for that, please?

Colonel BURTON. No, I am afraid I can't. I think that is a very good question. I think you should ask the Army.

Mr. DICKINSON. I have asked the Army time and time again, and they have no answer for it, they don't do it, and I was hoping maybe you could help me. It is dumb.

Colonel BURTON. I am not here to defend them.

Mr. Dickinson. Auxiliary tanks, they could jettison when they get into a situation where they need to, already fully topped off, they don't have to worry about being shot. All you have to do is pull a lever, the tank rolls off, it is just, the Israelis do it, the Israelis had them built on there to APC's because—I forget who the outfit that makes APC's for the Israelis—they spent like $60,000 extra to put the auxiliary external tanks because they realized that they were——

Colonel Burton. I believe our own Army is moving in that direction on their M-113.

Mr. Dickinson. Well, maybe by the year 2000 we can get around to it.

Colonel Burton. I believe that decision has been made, and they are committed to that on the current production version.

Mr. McCloskey. Generally speaking, can you express the enthusiasm of the services for the joint live-fire testing program, what kind of support are you getting in the Pentagon?

Colonel Burton. Well, it began with a lot of support. When the program was formally proposed to the services in 1983, and at that time they endorsed the concept completely. As we began to get closer to actually conducting it, there was some resistance that showed up.

Presently I believe the support is there, in many cases reluctant, but the commitment has been made to conduct the program in the original concept that was envisioned, and it is being done that way.

Mr. McCloskey. I noticed in your prepared testimony, you make a statement to the effect that just about every time the Bradley is hit, our troops would have to exit the vehicle. Could you comment on that, particularly as to the reports of the National Defense Journals that the vehicle is vulnerable to Soviet small-caliber weapons fire?

Colonel Burton. I plan to cover that in my briefing.

Mr. Nichols. You say there has been a minimal of objections to this program that has developed since 1983. Would you state to the committee the nature of that objection?

Colonel Burton. Gentlemen, there is a tendency to not want to conduct tests that hurt. The people are afraid that perhaps imperfections will show up that maybe should not. Unfortunately, the initial resistance manifests itself in that way. It has been a constant battle to overcome that and to get people to understand that once the data is out on the table, it can be looked at objectively and unemotionally and then, and only then, can it be figured out what the best course of action is concerning the weaknesses and the strengths that have shown up.

There is a tendency to not want to discover bad news. It is that simple.

Mr. McCloskey. Would you say the only way to correct the situation lies with General Hollingsworth's ideas to, in effect, remove it from the Pentagon to have an independent test, administrative apparatus?

Colonel Burton. I don't think, that any administrative process will solve the problem. You must have people involved in this business who are willing to do it, and it doesn't matter where the organizational chart shows them residing. I do agree with him about the problem of people in the service trying to force their own service or other services to do things that maybe they don't really want to do for whatever reason. There are pressures there. It is unfair to place servicemen in those kinds of pressure positions.

There are easier ways to do it, but I don't think any organizational chart is a recipe for success. It is the kind people that are put in charge to do it. That is what makes it different.

Mr. McCloskey. How about through Mr. Bennett's suggestion, how about an inspector general system?

Colonel Burton. I agree with the notion or the idea of independent views, as you will see in the statement. That is a fundamental principle. Independent views, independent observations, and independent reports, that is one way to keep the system fair and square.

Mr. McCloskey. I say I am looking forward to hearing specifically how vulnerable you think this Bradley is right now.

Colonel Burton. I will have some comments later.

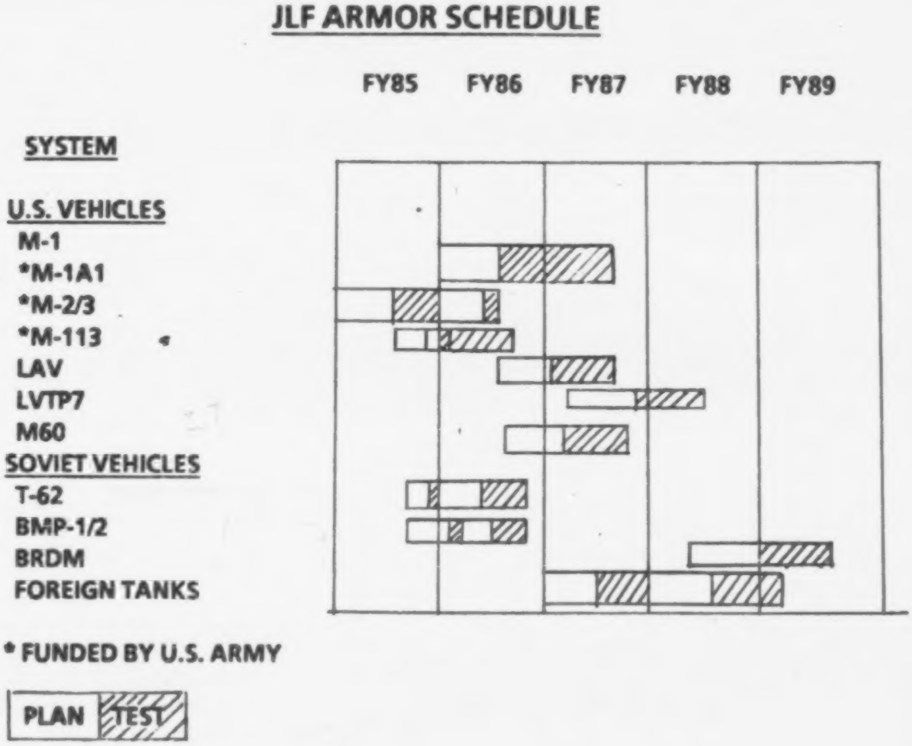
Mr. Price. Any further questions?

Colonel Burton. Shall I continue?

Mr. Price. Yes.

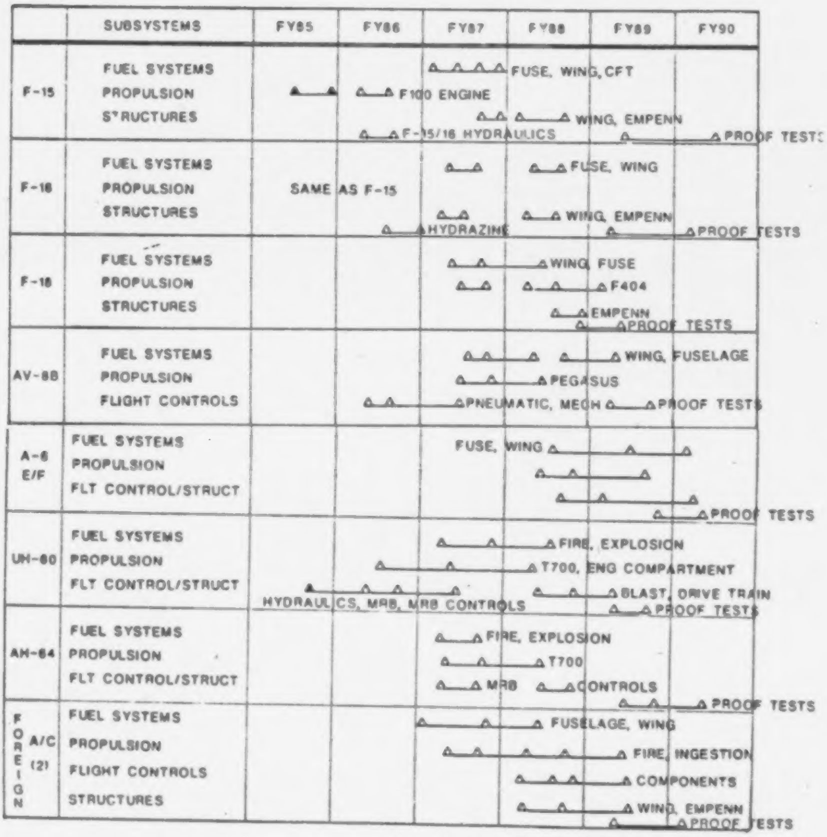
WHAT VEHICLES AND WEAPONS ARE SCHEDULED FOR JOINT LIVE-FIRE TESTING

Colonel Burton. What vehicles are scheduled for the whole program, and I want to make sure you understand this is a very broad program, not just a Bradley program.



In the armored side of the program, you see the U.S. vehicles listed there. The asterisks indicate those in which the U.S. Army has offered to fund. It is Russian weapons against United States vehicles and United States antiarmored weapons against Soviet vehicles. There are two parts to the program, test the current configuration, find out the weaknesses and strengths and what the problem areas are, where you need to make improvements, and then go back and retest possible fixes. As you can see, on the Bradley portion of the program, the first part has been completed. The current configuration has been tested. Certain problem areas have been identified and possible solutions are now being considered. They will be tested this spring. In a repeat of the process from last fall, tests will be conducted to see which of those candidates best solve the problems that surfaced, during the effort last fall. That is the nature of the program. This is the armored program.

JLF SCHEDULE/AIRCRAFT



NOTE: FOR CLARITY, NOT ALL TESTS ARE SHOWN

There is also an aircraft program, F-15, F-16, F-18, AV-8, A-6, two helicopters and two foreign systems.

JOINT LIVE FIRE ACHIEVEMENTS TO DATE

- **COMPLETED TEST TO DESTRUCTION OF THE F-15/F-16 ENGINE VULNERABILITY TO FUEL INGESTION.**
- **COMPLETED THREE LIVE FIRE SHOTS OF U.S. 105MM TANK ROUND AGAINST SOVIET T-62 TANK.**
- **FINALIZING TEST PLAN FOR 50 + LIVE FIRE SHOTS AGAINST M1A1 TO START THIS MARCH.**
- **COMPLETED 10 LIVE FIRE SHOTS AGAINST BRADLEY, SOVIET BMP AND NINE AGAINST THE ITV VERSION OF M113.**

Since the beginning of the program in late fiscal year 1985, there have been some achievements. We have taken an F100 engine, which is the engine in the F-15 and F-16, to total destruction, tested for vulnerability to fuel ingestion. We have completed three shots of 105 tank rounds against a Soviet T-62 loaded with fuel, and ammo, I might add that it blew up all three time. This test series will reconvene here within the month, and we will do a thorough scrub of that system by late spring.

We are now finalizing the test plan for the latest version of the M-1 tank, and the M-1A1. Over 50 live-fire shots are planned against that vehicle beginning in March.

This represents a tremendous change in the testing business. Our negotiations with the Army 1½ years ago on the conduct of the Bradley program resulted in only 10 live-fire shots against a vehicle. Since then, I can see a change in the mood, thinking and the way of doing business, it, as evidenced by the fact that the entire test program and the M-1 tests will be conducted against fully loaded vehicles. No dummy ammo. All shots will have fuel, live ammunition and engine running. To me, that is a tremendous change in the way the armored community has done its business.

And as the last one there, 10 live-fire shots against the Bradley, the Soviet BMP counterpart to the Bradley, and 9 against the Improved TOW Vehicle version of the M-113.

I would like to address some of the primary lessons that we have learned thus far. This is the diagram of the M-3 version of the Bradley, you can see the location of fuel, and ammunition. This view is from the front as you look through the vehicle. The internally stowed ammunition is clearly visible.

Looking down from the top, the M-3 configuration has five people in it. There is a driver, two people in the turret, and two troopers in the back. The M-2 configuration carries nine people, a driver, two in the turret, and six in the back.

WHAT HAVE WE LEARNED FROM THE BRADLEY TESTS

What have we learned from those tests last fall? This vehicle, like the other two vehicles that were tested, is a lightly armored vehicle, and the internally stowed ammunition is the primary hazard to the crew. When that ammunition is hit, casualties increase over when it is not hit by a factor of 2 to 3, depending on which ammmunition is hit and how hard and what the conditions are.

The fuel and fire extinguisher in the troop compartment may force the troopers to evacuate the vehicle. There is a very foul atmosphere inside the vehicle whether you hit ammunition or not. We are still at differences with the Army on this issue because of our concern over the atmosphere inside the vehicle following a hit. The Army has agreed to take gas measurements in the vehicle in the spring series and characterize the gas that is inside the vehicle. Will we have a better understanding of what the noxious gases are inside the vehicle.

Mr. McCurdy. What creates the gas?

Colonel Burton. There are three sources. It comes from three different places.

When a shape charge passes through aluminum armor, there is a vapor fireball formed inside the vehicle that last 50 to 100 milliseconds. A byproduct of those aluminum particles, as they burn is a white milky smoke. I am not quite sure what it is. No one else is either, but you can't breathe it. This smoke is present when either ammunition or fuel is hit. If fuel is hit, and there is a fire, the halon fire extinguisher discharges. The halon reacts with the fire, and produces byproducts. Those byproducts are hydrogen floride and hydrogen bromide. Certain concentrations of these products are harmful to the respiratory system. Halon itself, in its pure natural state, is not lethal, it is not a major health hazard; however, in the concentrations that we are talking about, it tends to make you momentarily dizzy, with a loss of balance and reduced mental capability. Basically a feeling of intoxication.

So there are three sources and the interactions of all of those three in there is just quite simply unknown. The Army has agreed to take measurements and characterize that atmosphere inside the vehicle this spring.

Mr. McCloskey. How about the Soviets' small arms question? I think we are at the appropriate part in the presentation.

Colonel Burton. I have forgotten the small arms part.

Mr. McCloskey. There have been reports, particularly in Jayne's Weekly, as to allegedly extreme vulnerability to Soviet small arms fire, the tank itself.

Colonel Burton. The vehicle itself?

Mr. McCloskey. Yes, have you evaluated that?

WHAT HAVE WE LEARNED ABOUT CASUALTIES FROM THE BRADLEY TESTS?

- **AMMUNITION IN THE TROOP COMPARTMENT IS THE MAJOR CAUSE OF UNNECESSARY CASUALTIES:**

  WHEN AMMO IS HIT, BRADLEY CASUALTIES
  INCREASE BY FACTORS OF 2 TO 3;
  SAME FOR BMP AND ITV

- **FUEL + FIRE EXTINGUISHERS IN THE TROOP COMPARTMENT MAY FORCE TROOPS OUT OF THE VEHICLE ALMOST EVERY TIME IT IS HIT.**

- **BRADLEY CASUALTIES CAN BE SIGNIFICANTLY REDUCED; MOVING AMMO, FUEL AND EXTINGUISHERS OUT OF THE TROOP COMPARTMENT WOULD PROVIDE THE GREATEST COMBAT CASUALTY REDUCTIONS.**

- **WHEN AMMUNITION WAS HIT, M2 BRADLEY CASUALTIES WERE ABOUT THE SAME AS BMP CASUALTIES; THE BRADLEY's AMMUNITION PRESENTS ABOUT THREE TIMES AS MUCH AREA TO HITS AS DOES THE BMP'S AMMUNITION.**

Colonel Burton. The armor protection level for the vehicle was for 14.5 millimeter and smaller which is basically small arms and artillery fragments. I understand that there may be a Soviet 7.62 sniper round around which may penetrate different places. But there was a U.S. surrogate of that round tested in 1981 during the ballistic test, and I can't recall whether or not there were penetrations. The Soviet 7.62 round has the capability to penetrate 2 inches of aluminum armor. So I really don't know if that answers your question.

Mr. McCloskey. Do you feel there is a small arms vulnerability problem then?

Colonel BURTON. No, I really don't, based upon what I have seen.

Mr. MCCLOSKEY. Thank you.

Colonel BURTON. The M-3 configuration, is the one that was tested. The M-2 was not tested. When we extrapolate the M-3 results to the M-2 configuration, we get casualty levels that are about the same as what the Soviet BMP were, because it carries 10 in 1 version, 11 in another.

WHAT HAVE WE LEARNED ABOUT EFFECTIVE CONDUCT OF LIVE FIRE TESTS FROM THE BRADLEY EXPERIENCE?

- **INDEPENDENT OVERSIGHT AND REVISION OF INITIAL SERVICE TEST PLANS, WHERE APPROPRIATE, IS CRUCIAL.**
- **INDEPENDENT ON-SITE OBSERVATION AND ACCESS TO ALL RAW DATA IS CRUCIAL.**
- **INDEPENDENT ASSESSMENT ON RESULTS, IN PARALLEL WITH SERVICE ASSESSMENT, IS CRUCIAL.**
- **THERE MUST BE NO COMPROMISE WITH THE PRINCIPLE OF SHOOTING REAL WEAPONS AT REAL, COMBAT-LOADED TARGETS--DESPITE THE VESTED INTERESTS OF PROGRAM ADVOCATES AND THE PRECONCEPTIONS OF TECHNICAL SPECIALISTS.**

What have we learned about conducting a program like this? Once again, I must emphasize the notion of independence and independent views. Independent review of the test plans and the authority to revise them, where necessary are crucial, as are on-site observations and access to all the raw data. An independent assessment of the results in parallel with the service assessment is also crucial. I must inform you that my management, and my superiors are not in total agreement with me on that point. This statement represents, at this point, my own personal view. The last point is one that there is a never-ending battle. To ensure that no compromise on the principal of using real Russians weapons against real targets. It is not simple to do when you have not been in the business of doing it that way over time.

LAST INSIGHTS

- **WE NEED LIVE FIRE TESTING FOR EVERY SYSTEM THAT EXPOSES SIGNIFICANT NUMBERS OF SERVICEMEN TO DANGER IN COMBAT--BOTH BEFORE THE DESIGN IS FINALIZED AND FOR THE PRODUCTION VERSION.**

- **WITHOUT CONTINUING YEAR-IN AND YEAR-OUT ATTENTION FROM THE SEC DEF AND THE FUNDING SUPPORT FROM CONGRESS, COMBAT-REALISITC LIVE FIRE TESTING WILL FADE AWAY.**

Lastly, I would like to say that we need this kind of a program on any system which exposes large numbers of servicemen to danger. This kind of testing needs to be done in a development phase before the design is fixed, and in the operational testing phase on the production version. Without continuing year in and year out support and interest by the Secretary of Defense, and the Congress, I do believe that this type of program will fade away.

That concludes my statement.

Prepared Statement of Col. James G. Burton

Thank you Mr. Chairman for the opportunity to address this committee and explain the Joint Live Fire Test Program. The purpose of this program is, quite simply, to save U.S. lives by testing to ensure that: (1) U.S. weapons platforms do not unnecessarily endanger their crews, and (2) The weapons U.S. servicemen fire actually stop the enemy. This program affects the lives of over 300,000 servicemen who may have to use this equipment in combat.

There has never been a program to shoot real Soviet weapons at U.S. vehicles loaded with the dangerous materials they have to carry in combat; fuel, hydraulic fluid and live ammunition. Nor has there been a program to shoot U.S. weapons against combat loaded Soviet vehicles.

Our weapon systems today are procured with computer-based vulnerability/lethality estimates, little firing data and no full up live firing results. What are the consequences of not conducting realistic-combat live fire testing? When actual combat occurs, we discover, too late, serious short comings in our weapon systems; short comings which cost lives. There are many accounts from WWII, Korea and Vietnam where U.S. "bazookas" failed to stop enemy tanks due to inadequate warheads. In WWII, Korea and Israel, U.S. tanks proved excessively flammable and vulnerable. The Israeli experience of 1973 showed that the U.S. M-60 burned or blew up twice as often when hit as the British Centurion, and more often than its predecessor, the M-48. Concern over excessive casualties caused the Israelis to make several changes to their M-60s; different hydraulic fluid, fire extinguishers, special armor packages, etc. This painful experience of excessive casualties also led them to a unique armor concept in their Merkava tank which sacrifices the tank in order to protect the crew. In Vietnam, U.S. fighters also proved to be unnecessarily flammable and vulnerable. Fire and explosion caused the loss of at least 60 percent of the 5,000 U.S. aircraft downed in Vietnam. During the course of the war, survivability improvement kits had to be hastily developed and installed on fighters such as F-4 and F-105 to reduce their vulnerability. In 1982, Congress directed a competitive "Shoot off" between candidate modern day bazookas to determine which one the Army would procure for its infantrymen to kill tanks. Six candidates were tested, and a winner was selected, the AT-4. Over 400 rounds were fired during that major competition, yet not one round was fired against an actual tank; not even on an empty tank, let alone one loaded with fuel, hydraulic fluid and live ammunition. As a consequence of not doing combat-realistic live fire testing, we have no idea whether today's "bazooka," tanks or first line fighters have improved this situation. The Joint Live Fire Test Program was initiated by OSD in 1984 to answer this question, and to assist in making sure real improvements happen.

The program was formally chartered by OSD to begin in late FY 85 and conduct live fire testing of front line U.S. armor and aircraft systems. Soviet anti-armor weapons are being tested against U.S. tanks (M-1, M1A1, M-60) and armored personnel carriers (M-2/3 Bradley, M-113, LAV, and LVTP7). U.S. antiarmor weapons such as Law, AT-4, TOW, etc. are being tested against Soviet tanks and armored personnel carriers. Soviet antiaircraft weapons are being tested against actual F-15, F-16, F-18, A-V8B, A-6E/F, US-60 and AH-64 aircraft. Conversely, U.S. antiair weapons are being fired against Soviet aircraft. The program schedule is attached to this statement.

Since the program began in late FY 85, there has been considerable progress. To date we have: (1) Completed a test to destruction of the F-15/16 engine vulnerability to fuel ingestion, (2) completed three live fire shots of U.S. 105MM tank round against the Soviet T-62 tank. Firings of other U.S. rounds, including we hope, the AT-4 antitank rocket, against T-62s will begin in late February, (3) finalizing the test plan for 50+ live fire shots against the M1A1 tank to start this March, and (4) completed 10 live fire shots against the Bradley, and the Soviet BMP (Soviet counterpart to the Bradley), and nine shots against the improved TOW vehicle version of the M-113 armored personnel carrier.

Since the primary purpose of the Joint Live Fire Program to ensure that U.S. weapons platforms do not unnecessarily endanger their crews, let us examine what we have learned about casualties from the Bradley tests. The most important lessons are:

(1) Ammunition stored in the troop compartment is the major cause of unnecessary casualties. When this ammunition is hit, Bradley casualties increase by factors of two to three; the same can be said for the Soviet BMP as well as the U.S. ITV.

(2) Fuel and fire extinguishers in the troop compartment may force the troops out of the vehicle almost every time it is hit, thereby causing greater risk of added casualties. The atmosphere inside the vehicle after a hit is simply intolerable.

(3) Bradley casualties can be significantly reduced. Moving ammunition, fuel and extinguishers out of the troop compartment would provide the greatest combat casualty reductions.

(4) When ammunition is hit, M-2 Bradley casualties are about the same as the Soviet BMP casualties; the Bradley's ammunition presents about three times as much area to hits as does the BMP's ammunition. Thus in combat, greater total casualties can be expected.

Since there has never been a program like this before, it would also be useful to examine what we have learned about the effective conduct of live fire test from the Bradley experience:

(1) Independent oversight and revision of initial service test plans, where appropriate, is crucial.

(2) Independent on-site observation of the tests and access to all raw data is crucial.

(3) An independent assessment on results, in parallel with the service assessment, is crucial.

(4) There must be no compromise with the principle of shooting real weapons at real combat-loaded targets—despite the vested interests of program advocates and the preconceptions of technical specialists.

> There are two final insights from this experience which are worthy of note:
>
> We need live fire testing for every system that exposes significant numbers of servicemen to danger in combat. We need this testing both before the design is finalized, and for the production version.
>
> Without continuing year-in and year-out attention from the Secretary of Defense and the funding support from Congress, combat-realistic live fire testing will fade away.

Mr. PRICE. Any questions?

Mr. NICHOLS. Mr. Chairman, I have a question I would like to ask the gentleman, if I might. I gather from what you said, you are advocating independent tests on letting the Army, Air Force, and Navy do their own tests, am I correct in that? You seem to have some mistrust in the system?

Colonel BURTON. That is correct.

Mr. NICHOLS. You seem to be skeptical.

Colonel BURTON. I most certainly am and yes, those are the correct words. That is why I believe very strongly in the notion of independence. Open the door up, and let's all take a look. There should be nothing to hide. It is just a matter of maintaining an openness and a willingness to look at and accept the test results objectively no matter how they turn out.

Mr. NICHOLS. The Army has tested this particular Bradley vehicle?

Colonel BURTON. That is correct.

Mr. NICHOLS. What is your view of the Army's test, and wherein do you differ with the tests that the Army made?

Colonel BURTON. A year and a half ago, we negotiated the manner in which this test would be executed. It was a very intense negotiation, and when it was finalized, the agreement was that they would conduct at least 10 live fire shots before the end of fiscal year 1985. We negotiated back and forth on the detailed test plan and it was all settled in late 1984. Since then, the Army has conducted the tests like they said they would do.

I have to go back to where I was at that point in time negotiating how much real live fire shots I could get the Army to agree to. I wanted all shots to be live fire against a fully loaded vehicle. The Army would only agree to 10 shots. In those 10 shots, they did not want to intentionally strike internal ammunition but come close, to resolve uncertainties. During those test plan negotiations, I insisted that if there were no vehicles lost during those 10 shots, there would be another series of tests in which the Army would move back to an operational range and put some more randomness into the test. In those shots, the aim point would be the center of the silhouette and the attack direction would vary around the vehicle. Shots would continue until one vehicle was lost.

The "Burton" tests, or random shots never were executed because one vehicle was lost during the 10 controlled shots. The 10 controlled shots had impact points and shot lines to come close to ammo, but not hit it, to see if spall fragments or other things would set off the ammunition inside. There was a set of off-line tests where they fired directly into ammunition in a ballistic hull and turret vehicle and measured the violence of that reaction. So those reactions were known and documented. When we step back from it all and look at all of the data from all 68 shots, I think you have a pretty good idea of the vulnerability of this vehicle.

Mr. NICHOLS. Who in the Office of the Secretary of Defense approved the Army test plan for the Bradley, can you tell us that?

Colonel BURTON. At the time it was the Office of the Director of Defense Test and Evaluation. The test plan was submitted to us. It was staffed throughout the ASD staff and comments were sent back, to the Army.

Mr. NICHOLS. Did the Office of the Secretary of Defense monitor the survivability tests?

Colonel BURTON. Yes; I did personally.

Mr. NICHOLS. Who?

Colonel BURTON. I did.

Mr. NICHOLS. What is the Secretary, Office of Secretary of Defense position on casualties?

Colonel BURTON. Position on casualties?

Mr. NICHOLS. Yes.

Colonel BURTON. Well, I am not quite clear what the official position is. One of the disagreements we have right now is interpreting results.

Mr. NICHOLS. That is what I am asking.

Colonel BURTON. Yes.

Mr. NICHOLS. You are in disagreement with them on that?

Colonel BURTON. That is correct. We disagree on what constitutes a casualty. I might point that out that the Army medical community is also in disagreement within itself on this point.

Mr. NICHOLS. Does the medical people, the Surgeon General's Office and so forth, are they in agreement with you on casualties?

Colonel BURTON. No, they are not. We have a disagreement on what constitutes a casualty. The main area of disagreement is casualties due to blast-over pressures.

Mr. NICHOLS. Let me say, Mr. Chairman, the thing that troubles me a great deal is that the Colonel seems to be highly skeptical of the system the way we are now testing these things, that bothers me a great deal, because it is something that we depended on over the years. I am not necessarily knocking or opposed in any way to what your tests, your idea, but it troubles me a great deal that the skepticism you seem to have in the system, in the validity and the truthfulness of perhaps of some people who are given this committee and other committees of Congress information on the testing that they are doing.

Mr. MCCURDY. Mr. Chairman.

Mr. NICHOLS. I yield.

Mr. MCCURDY. Let him answer.

Colonel BURTON. I agree that I have a skeptical view of things, but my perspective comes from over a long period of time of looking at promises made and promises not kept; of looking at initial service reports on what the test results are and then when I dig into those results and find that the actual raw data doesn't quite match up to what was initially reported. I think that if you talk to people who have been in the testing business for some period of time, you will find that a natural skepticism evolves from that kind of perception.

Mr. MCCURDY. I have no further questions.

Colonel, I am delighted that you have some skepticism, it is nice to see that there may be at least some room for dissent, not a lot of room, but some room for dissent within the Pentagon over there. My question is, as to the structure of your office, if I am repeating an area, I am sorry for having to be out for a few minutes, but what authority do you have, you are talking about negotiating agreements, contracts, in effect, with the services in the area of testing on a specific system. What authority do you have as far as saying there will be a test, it is going to be a BC&D?

Colonel BURTON. My authority on the Bradley, M-113 and the M-1 tank comes from a written agreement of management arrangement between the Army and USDR&E in which, in the first Bradley test, the Army invited me personally to participate in the planning, execution, and on-site observations of the program. It was Dr. Skelly, Army Assistant Secretary of R&D, who personally invited me September 28, 1984, that management arrangement was written into the agreement. The same arrangements have been applied to the M-113 tests and the M-1A1 tests.

Mr. MCCURDY. What you are saying is——

Colonel BURTON. I will be glad to provide to you that documentation.

[The following information was received for the record:]

AUTHORITY DOCUMENTATION

THE UNDER SECRETARY OF DEFENSE
WASHINGTON, DC 20301-3010

RESEARCH AND
ENGINEERING

11 OCT 1985

MEMORANDUM FOR UNDER SECRETARY OF THE ARMY Jim

SUBJECT: M-1 Vulnerability Tests

Your request of October 4 to withdraw the M-1 from the Joint Live Fire Test Program in order to accelerate the tests under Army funding is approved. The management arrangements for OSD participation will be the same as those established previously for the Bradley and M-113 vulnerability tests. Accordingly, Colonel Burton of my staff will participate in the planning and execution of the tests, to include on site observations. Future correspondence on this subject should be addressed to my Director of Defense Test and Evaluation.

Don Hicks
Donald A. Hicks

DEPARTMENT OF THE ARMY
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D.C. 20310

4 October 1985

MEMORANDUM FOR THE DIRECTOR, OPERATIONAL TEST AND EVALUATION

SUBJECT: M1 Vulnerability Tests--ACTION MEMORANDUM

In order to expedite the M1 vulnerability tests, the Army requests permission to withdraw the M1 from the Joint Live Fire Program. This action will enable the Army to accomplish the M1 series tests in 1986 vice 1988 and will provide data to support decisions on proposed improvements to the M1A1.

M1A1 tanks have been selected as the specific test vehicles in order to acquire vulnerability information on our best main battle tank. Information developed from the tests will be provided to OSD by HQDA. The test will be conducted IAW the general guidelines of the JLF program with OSD participation. Informal coordination with OSD, Office of the Director, Operational Test and Evaluation has been accomplished.

James R. Ambrose
Under Secretary of the Army

OFFICE OF THE UNDER SECRETARY OF DEFENSE
WASHINGTON DC 20301

RESEARCH AND
ENGINEERING
(DDTE)

11 SEP 1[illegible]

Watt

MEMORANDUM FOR ~~DEPUTY~~ UNDER SECRETARY OF THE ARMY
(OPERATIONS RESEARCH)

SUBJECT: M-113 Vulnerability Test

Your request to withdraw the M-113 Vulnerability Tests from the Joint Live Fire test program is approved. Under the agreed to oversight arrangements, Col Burton of my staff will participate in the planning and execution of the M-113 program which will begin in October.

C Watt
CHARLES K. WATT
Acting Director
Defense Test and Evaluation

DEPARTMENT OF THE ARMY
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D.C. 20310-0102

5 September 1985

SAUS-OR

MEMORANDUM FOR: ACTING DIRECTOR, DEFENSE TEST AND EVALUATION, OUSDRE c 9/6

SUBJECT: M113 Vulnerability Test

Request withdrawal of M113 from the JLF Program. This will accelerate the testing and provide data to support decisions on proposed improvements to the M113. We agree with the same oversight arrangements for the M113 that are in effect now for the M2/M3 Bradley Vulnerability Test Program. However, we ask that restrictions be placed on the use of any raw data until after our testers have had an opportunity to analyze it.

Walt

Walter W. Hollis
Deputy Under Secretary of the Army
(Operations Research)

OFFICE OF THE UNDER SECRETARY OF DEFENSE
WASHINGTON DC 20301

RESEARCH AND
ENGINEERING

28 SEP 1984

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (RD&A)
JOINT LOGISTICS COMMANDERS

SUJECT: Joint Live Fire Test Anti-Armor Phase

As a result of agreements reached in the meeting in my office on September 21, 1984, between Dr. Sculley, Mr. Meyers, representing the Joint Logistics Commanders and my staff, the proposed Joint Live Fire (JLF) test plan submitted on August 21, 1984, is approved with the following changes:

a. The M-2/3 Bradley vulnerability tests will be conducted by the Army separate from the JLF program. The Army agreed to provide the required assets and funding to complete the tests in FY 85. The FY 85 tests will include a series of preliminary tests against inert and partially loaded vehicles and will culminate with a minimum of at least 10 tests of Soviet anti-armor weapons against M-2/3 vehicles configured as they will be for combat with fuel, ammunition and hydraulic fluid. In FY 86, the Army will test M-2/3 vehicles modified with survivability enhancements such as spall suppression liners, reconfigured fuel tanks/ lines, revised ammunition stowage configurations, etc. The Army agreed to provide the results from these two test programs to the JLF data base. At the invitation of Dr. Sculley, Col Burton, of my staff, will participate in the planning and execution of the Army tests, to include on site observation of the tests.

b. The JLF program for FY 85 will concentrate on testing T-62s. The FY 86-89 efforts will be restructured to place more emphasis on testing US vehicles so that improvements can be made in a timely fashion. The restructured plans will identify the specific number of weapons to be tested against fully combat configured vehicles, and the associated costs, so that appropriate funds can be reserved for that purpose. The proposed tests of a T-62 with postulated applique armor is not an appropriate effort for the JLF and will therefore not be funded. The testing of more up-to-date vehicles will be approached through a different process.

Based upon the above changes, the FY 84 JLF funds have been released. FY 85 funds will be released upon receipt of the restructured FY 86-89 plans described above.

Jim Wade

James P. Wade, Jr.
Principal Deputy Under Secretary
of Defense for Research & Engineering

Mr. McCurdy. What you are saying, you have no problems with the conduct of those tests?

Colonel Burton. No; it is just that internal, inside-the-building negotiations on what we are going to do, how real it is going to be, how many shots, and is it a normal negotiation; sometimes all that is intense and difficult.

Mr. McCurdy. Do you think an equal party to those agreements, how much authority do you have going into negotiations—those—if you say if you come to whoever is the person you are negotiating with and say "I believe, based on my experience and judgment, that you ought to have 50 rounds shot at it instead of 10," what position do you have to back you up?

Colonel Burton. I don't know how to answer that, but that has been the case over the past year.

Mr. McCurdy. Can you make the decision?

Colonel Burton. I cannot make it myself. It depends upon how much support I have from my superiors and how much they are willing to negotiate for that.

Mr. McCurdy. Who is your immediate superior?

Colonel Burton. I believe that my immediate superior right now is Dr. Navarro. We are in the process of reorganizing. My immediate superior is Brigadier General Jones, and then above him is Dr. Navarro or Mr. Charlie Watt and then Dr. Hicks. I am not quite sure whether they have passed the baton yet. In the previous negotiations for the Bradley, Dr. Wade was acting USDR&E and my support was there.

Mr. McCurdy. If you are in disagreement with the particular service—and I am not saying on any particular system, but with a service on a test, do you submit a memo of disagreement or do you send something up the chain to your superiors?

Colonel Burton. All of the above.

Mr. McCurdy. How often have you had to do that?

Colonel Burton. Quite often.

Mr. McCurdy. How often have you been successful?

Colonel Burton. Fairly successful, more successful lately than earlier.

Mr. McCurdy. I am going to ask you a personal question, then. Do you have a recommendation other than what you submitted here as to the system? Do you believe that the office itself has the authority to determine or force a decision based on what you feel to be the appropriate method of testing?

Colonel Burton. I think it would be useful to have the authority to either reach down into the services and get more test assets, either the authority and maybe the funding to pay for them. Right now we have to depend upon the cooperation of a program manager to offer up the assets. I have to depend upon the intelligence community to go out and get foreign equipment, and they don't seem to be structured to do very much of that, so we wind up arguing over what is a good surrogate.

It would be very useful to have authority to fence off a certain number of assets on this particular weapons system, to have it directed toward these kinds of tests. It would be very helpful to have a little more money, so I can actually go out and buy some more

Russian tanks. They are hard to come by. There are many things like that which would make it a little bit easier.

Mr. PRICE. Any further questions?

Mr. MCCLOSKEY. Mr. Chairman, just following up for a moment on what Mr. McCurdy has been working here. From your testimony, Colonel, and also from Mr. Battista, it would appear that from time to time testing data is either deliberately falsified or somewhat recklessly or deliberately misconstrued or misstated would be a better word. To your knowledge, does anyone ever get into severe trouble over there for such action? What does happen?

Colonel BURTON. On occasions there have been disagreements when the actual data showed up. I am thinking back to the Inspector General's investigation on the DIVAD exercise a couple of years ago when certain rather glossy interpretations were briefed at the DSARC process and then the test report was made available about a year later and it didn't match the briefings. That started an investigation but I don't recall anyone actually being reprimanded.

Mr. MCCLOSKEY. Can you elaborate on that a little further? Should there be a process to make any more serious or sanction situation if and when it does occur that people realize that they are dealing with a very egregious situation?

Colonel BURTON. Yes, I would agree with that. I believe when all the actual data is put on the table, reasonable men can disagree on what to do about it, once they see it all. The problem is we don't always get to see it all. We get selected data.

Most of the data we see is structured with advocacy in mind, and to find out where the ground truth is you have to go looking for it. I think once you break down those barriers and people become accustomed to putting in all the data results in an objective fashion, then people begin to understand what they actually have and will accept it more openly.

Mr. MCCLOSKEY. It is humanly possible to do that, and at some point could we ask you for specific recommendations?

Colonel BURTON. Yes, it is very difficult, and I would be glad to give you some recommendations.

[The following information was received for the record:]

RECOMMENDATIONS

The following are my personal recommendations and opinions:

I need authority to acquire the U.S. vehicles that need to be tested for survivability and to acquire U.S. weapons that need to be tested for lethality.

Because of the exponentially expanding test load, I need two staff assistants and the authority to select them.

There is an urgent need to expand the planned program to test key naval systems, most importantly, the Mk 46 torpedo against decent representation of the most survivable Soviet submarines and some key Soviet anti-ship missiles against decent representations of current U.S. destroyers and cruisers.

Mk 46 is the only U.S. surface ship and airplane-launched ASW weapon we have.

Current destroyers and cruisers may be as flammable or worse than the Sheffield.

More funding is needed for a) acquiring foreign weapons and targets, and b) acquiring U.S. missiles to shoot and for relatively expensive U.S. vehicles to shoot at.

Congress needs to ask for and then review the results of live fire testing for each major new weapon system in R&D where large numbers of servicemen will be exposed; they also need to review progress in testing the important vehicles now in production or in inventory that might be modified to reduce casualties. The same needs to be done for in-production or in-inventory ammunition and missiles.

Mr. McCloskey. Thank you, Colonel.

Mr. Bennett. May I inquire at this point? Will the gentleman yield?

Mr. McCloskey. Yes.

Mr. Bennett. Following up on that very point, what can Congress do to help you do your job better or somebody else in your position do this job better than you are now able to do it? Are there some laws that if put in place might make it more authoritative, to have this realistic testing?

Colonel Burton. Yes. I think it would be useful to have more authority to task the services for test assets. It would also be useful to have more funding to acquire foreign assets. I can't impress upon you how difficult that is to do.

Mr. Bennett. I understand the sort of thing that you have testified to. What I am really mostly interested in is finding out whether there is something wrong in the governmental structure. Do you need something like the I.G. or some relatively independent sort of thing that has authority to require testing to be made, whether it is embarrassing or not?

Colonel Burton. I think that that would be helpful and useful. Anything that fosters the notion of independence, either independent organizations observing, or independent reports on results. The notion of independence tends to keep the system honest.

Mr. Bennett. You spoke as if you were negotiating to see what you could do. Can the various services turn you down if they don't like what you want to do?

Colonel Burton. Absolutely.

Mr. Bennett. That obviously needs some correction. Could you please summarize for us the key areas in which you agree and disagree with the Army report on the Bradley as an example?

Colonel Burton. The Army's report contains a fairly accurate and complete data base on what actually happened up there. My report took that same data base and interpreted the results in a different perspective with a different interpretation. By that I mean, as you see from the briefing that I gave you and my prepared statement, that my main concern is what do these results mean in terms of casualties; what can we do to improve that situation.

I wrote an independent report from the perspective of the people come first, the vehicle problems come second. I do believe that the Army's report had a different perspective than that. Most of their concerns appeared to be with the vehicle itself, and the implications on the casualties were second. They did not ignore the casualty implications, but I believe that they were somewhat underplayed.

Mr. Price. Thank you very much, Colonel, for your testimony.

Mr. Bennett. Mr. Chairman, could I put some questions in the record for Colonel Burton?

Mr. Price. Without objection.

[Mr. Bennett submitted the following questions to the witness to be answered for the record:]

DOD DEVELOPMENTAL TEST PROCEDURES-BRADLEY FIGHTING VEHICLE

Question: Colonel Burton, were you present during each of the 10 live-fire, full-up tests conducted against the Bradley?

Answer: I was present for each of the 10 live-fire, full-up tests conducted against the Bradley. In addition, I witnessed the majority of the 36 Bradley tests involving inert ammunition, the 8 shots at the Ballistic Hull and Turret vehicle and the 14 off-line ammunition shots. I also witnessed all but two of the live-fire tests against the Soviet BMP and the US ITV.

Question: The Army has gone on record as stating that the 10 live-fire shots show the Bradley to be far more survivable than the BMP or ITV. Would you agree with this statement, and if not, why not?

Answer: All three vehicles are lightly armored vehicles which are vulnerable to anti-armor weapons. The Bradley is physically larger than either of the other two vehicles and carries far more ammunition internally. Its ammunition presented area, from the side, is 3 times greater than the BMP. Thus, in actual combat we can expect far more catastrophic hits.

Question: I'd like to explore the realism of these 10 shots. Can you please explain for us how the 10 shots were selected and then comment on whether or not these shots are representative of what our infantry soldiers riding in the Bradley can expect in combat?

Answer: For these 10 live fire shots, the impact points and attack directions were not random nor representative of the locations of combat impacts. Instead, they were carefully selected to resolve vulnerability uncertainties. Shots for which there was a high probability of a catastrophic fire or explosion on the one hand, or trivial mechanical damage on the other hand, were deemed unnecessary and therefore avoided. For example, each of the 10 live fire shots was aimed so as to avoid intentionally striking the explosive elements of internally stowed ammunition--even though there are likely to be a fair number of direct hits on ammunition in real combat. During the live fire tests, there were two accidental impacts on internal ammunition. Additional "off-line" firings were conducted at individual potentially explosive components such as TOW missile launch motors, flight motors and warheads.

Question: What would you describe as the greatest threat to the crew and infantry should the hull of the Bradley be penetrated?

Answer: The large quantities of ammunition stowed in the troop compartment is the greatest hazard to the crew and the vehicle. When this ammunition is hit, casualties are 2-3 times greater than when ammunition is not hit.

Question: Can you please explain for us just how much fuel and ammunition is stored inside the Bradley and what its position is relative to the crew and infantry inside the vehicle?

Answer: The M-3 configuration was used for this test series. There are two fuel tanks. The fuel tank on the right side of the hull contained 27 gallons of diesel fuel and the main fuel tank, under the troop compartment contained 140 gallons. The troop compartment contained 10 TOW missiles, 40 boxes of 25mm cannon ammunition (with an additional 300 rounds stowed in the ready box in the turret), three LAW antitank missiles, two Claymore anti-personnel mines, several thousand rounds of 7.62mm and 5.56 ammunition as well as incendiary grenades and flares. The M-3 configuration has two troops in the troop compartment with this ammunition. The M-2 configuration has 6 troops in the troop compartment, but with somewhat smaller amounts of ammunition.

Question: I understand that these tests were conducted against M-3 Bradleys as opposed to M-2 Bradleys. Can you explain the difference between the two vehicles and what that difference will mean in terms of casualties should the hull be penetrated?

Answer: The M-3 carries a crew of 5, including a driver, a commander and gunner in the turret and two scouts in the troop compartment. The ammunition load consists of 10 TOW missiles, 1500 rounds of 25mm cannon ammunition, 3 LAW missiles, 2 Claymore mines, several thousand rounds of 7.62 and 5.56 ammunition, incendiary grenades and flares. The M-2 configuration has a driver, commander and gunner in the turret, plus 6 infantrymen in the troop compartment. To make room for the additional troops in the troop compartment, the ammunition load is slightly less than the M-3. The tests were conducted against the 5 man M-3 configuration. By extrapolation, the M-2 casualties would have been almost double the M-3 casualties.

Question: I understand that there were more than just 10 shots conducted. How many other shots were performed against the Bradley?

Answer: Ten shots were conducted against the Bradley loaded with fuel and live ammunition. In addition, 8 shots were fired against a Ballistic Hull and Turret vehicle (essentially the armor shell) loaded with fuel but no live ammunition to test the fire extinguisher, 36 shots at an operating M-3 loaded with fuel and inert, dummy ammunition and 14 shots at the BH&T directly into various amounts of live 25mm ammunition. For these 25mm ammunition shots, there was no fuel or other stowage aboard. The total test program involved 68 shots.

Question: Were any partially filled Bradleys ever destroyed completely during these shots? Would the casualties from such shots be significant?

Answer: There were no partially filled Bradley's completely destroyed. On a few occasions, shots into fuel cells resulted in sustained fuel fires, and for one reason or another the automatic fire suppression system did not work properly. Stand by firemen extinguished the fires before the vehicles were lost. These shots were considered "no tests" by the Army since the fire extinguisher set up was considered nonstandard. Casualties were not assessed on these shots.

Question: Are you aware of any tests that have been conducted by firing shots at boxes of 25mm ammunition similar to those in the Bradley? Could you please explain for us the results of such shots?

Answer: There was a series of "off line" tests in which a laboratory 3.2 inch diameter shaped charge was statically detonated through the hull of a Bradley Ballistic Hull and Turret Vehicle (an armor shell with no working subsystems) directly into 25mm ammunition stowed in the troop compartment. The amounts of ammunition stowed inside the vehicle varied from a single round to a full box of 30 for both the Kinetic Energy round and the High Explosive round. The violence of the reaction was measured and the results are contained in the Annex of the report given to Congress. While the violence of the reaction varied depending upon how many rounds were present, we can expect high casualties when more than just a few rounds are involved.

Question: Do you consider it a problem that the Bradley contains some forty of these ammunition boxes inside its hull?

Answer: Yes I do. When these boxes are hit, the reaction can range from a small ammunition fire which self extinguishes in a few seconds to a catastrophic explosion which will kill the entire crew and destroy the vehicle. There are ways to reduce this source of casualties such as stowing these ammunition boxes externally or in compartments which explode outward when hit, not inward into the troop compartment. The Army will test these possible solutions in the Phase II tests this spring.

Question: Do you consider it a problem for our infantry that numerous TOW missiles, flares, mines, etc. are stored internally in the vehicle with them?

Answer: The test results clearly showed that the internally stowed ammunition is the primary hazard to the crew and the vehicle. The Army also agrees with that finding. When the internal ammunition is hit, casualites were 2-3 times as high as when the ammunition was not hit.

Question: Were any shots conducted during this test series at reconfigured Bradleys with fuel or ammunition stored outside the hull, away from the troops? Was there any decrease in the number of casualties likely to occur?

Answer: There were no shots during this series at Bradleys reconfigured with fuel or ammunition stored outside the hull away from the troops. There was one shot into a TOW missile stowed in the TOW launcher on the outside of the turret. The casualties from this shot were 2-3 times less than other shots which struck ammunition stowed in the troop compartment.

Question: As far as you know, is the Army exploring options to remove fuel or ammunition from within the crew compartment?

Answer: The Army's initial proposal for Phase II testing of candidate modification packages did not consider a configuration which removed fuel or ammunition from the troop compartment. We have asked the Army to include in the Phase II tests a vehicle configured with all fuel and ammunition removed from inside and under the troop compartment and stowed either externally or in compartments which explode outward when hit, not inward into the troop compartments. The Army has agreed to test this configuration in Phase II this spring.

Question: The Army has stated that the Automatic Fire Suppression System inside the Bradley performed very well, extinguishing all of the fuel fires that occurred. Is this true? How does it perform against fires or explosions from ammunition?

Answer: The Automatic Fire Suppresion System was effective in extinguishing fuel fires. When the sensors detected a fire and the electrical system was not damaged by spall fragments or the penetrating round, then the fire extinguisher was very effective. However, it had a high false alarm rate and for every time it worked properly, it discharged twice when it was not supposed to. The system is effective against fuel fires, but has no effect on ammunition fires.

Question: Without getting into classified detail, are there any serious problems associated with the operation of the Bradley and its ability to stay on the battlefield and fight once the Fire Suppression System has activated?

Answer: The atmosphere inside the vehicle following a hit is intolerable due to aluminum vaporifics by products, Halon 1301 in its natural state, or the by products of Halon reacting with a fire, or a combination of all three, and may force the crew to evacuate. If they are forced out, then there are serious consequences. Those consequences include possibly additional casualties and relate to the ability of the Bradley to continue to fight even though the vehicle itself may still be functional.

Question: Given the configuration of the Bradley and its internally stowed ammunition, what is the liklihood that ammunition will be struck during combat should a shot be fired against it?

Answer: Depending upon the attack direction there is a high probability of internal ammunition being struck. The Bradley has three times as much ammunition area presented to an attacker (side view) as its Soviet counterpart, the BMP.

Question: I understand that there is an overpresurization effect inside the Bradley when internal ammunition explodes. The Army has stated that these tests proved that overpressurization was not a great threat to the crew. Would you agree with this statement? If not, could you please give us an example?

Answer: Test results showed that when internal ammunition is struck, the overpressures inside the vehicle varied depending upon how many rounds that were struck reacted. The effects of these overpressures vary from ruptured eardrums, to lung hemorrhages, to death, depending upon how many rounds reacted. When no ammunition was struck, the "vaporifics" overpressures were sufficiently high in some cases to cause ruptured eardrums for unprotected ears. The Army does not consider ruptured eardrums a casualty.

Question: The Army has stated that spall fragments were not a significant casualty producer. Would you agree with this statement? If not, could you provide us with an example?

Answer: I disagree with this statement. The Army's own report contains data which clearly shows that spall fragments caused almost three times as many casualties as the primary penetrator. As might be expected, the larger the penetrating weapon, the greater number of casualties resulted from spall fragments.

Question: I understand that the Army had some very detailed models of specific shot lines and the number of casualties likely to occur prior to these tests. Did you find those models accurate now that these tests have been conducted?

Answer: Computer based vulnerability models were used to generate pre-test predictions for all Bradley and BMP shots. During the diagnostic tests prior to the live fire shots, anomalies in the models were discovered which led to three major model revisions. The pre-test predictions were based on the third model revision. For the live fire series of 10 shots on the Bradley and BMP, the model predictions were reasonably accurate for 40 and 62 percent of the shots respectively, and grossly incorrect for the remainder of the shots. After three major revisions, the models clearly have no predictive value for individual outcomes. In addition, the models failed to predict the vulnerability of electric wiring, the fact that some direct hit impacts on ammunition do not lead to catastrophic explosions or sustained fires, failed to predict the structural failures resulting from dynamic warhead blasts on the outside of the vehicle, etc.

Question: The Army has estimated that it will cost between $50-$75,000 per vehicle to make quick fixes to improve survivability. As far as you are aware, does this estimate include the addition of armor to the vehicle? Do you have any data at this time that could give us an idea of how much armor is necessary to improve survivabiltiy and what its associated cost might be?

Answer: The answer to this question will not be known until the results of Phase II tests are available. During Phase II, candidate armor options will be tested and it is premature to discuss which options will actually work and which ones will be adopted.

Question: Colonel Burton, would you say that you have about as much knowledge as anyone working for the Secretary of Defense on the vulnerability of the Bradley Fighting Vehicle?

Answer: Yes.

Mr. PRICE. The next witness will be Gen. Maxwell R. Thurman, Vice Chief of Staff of the Army.

STATEMENT OF GEN. MAXWELL THURMAN, VICE CHIEF OF STAFF, U.S. ARMY, ACCOMPANIED BY MAJ. GEN. EDWIN H. BURBA, JR., COMMANDANT, INFANTRY SCHOOL, FORT BENNING, GA; LT. GEN. LEWIS WAGNER, DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION, DEPARTMENT OF THE ARMY; COL. ROBERT F. FOLEY, DEPUTY CHIEF OF STAFF FOR OPERATIONS, DEPARTMENT OF THE ARMY; AND BRIG. GEN. EDWIN S. LELAND, JR., CG NTC, FORT IRWIN, CA

General THURMAN. I am the Vice Chief of Staff, U.S. Army, and I brought a couple of experts along with me. One is on my right, Lt. Gen. Louis Wagner, the Deputy Chief of Staff for Research, Development, and Acquisition and a frequent visitor to your committee, and a Distinguished Service Cross holder, I might add.

On my left is Major General Burba, whose father, as indicated by General Hollingsworth, was also a distinguished general officer. General Burba now commands the Infantry Center at Fort Benning, GA.

On my right, on your left, is Brig. Gen. Ed Leland, who commands the National Training Center, which is the fulcrum of simulated combat, or as close as we can get, located at Fort Irwin in California, in the desert.

On my left, your right, is a distinguished young officer who has just come back from 2 years overseas in Germany. He is Col. Bob Foley, a Medal of Honor winner, who has commanded both a battalion of M-113's and a brigade of M-1 tanks and Bradley Lighting vehicles.

Not at the table but available for the committee are three distinguished soldiers sitting to my rear, Captain Derouchey, who commands a company of Bradleys now; Sergeant First Class Herrmann, who is a platoon sergeant and a master gunner for that unit; and a Private First Class White, who is the driver of the Bradley.

If you have specific questions for any of us, we will be happy to handle them.

First of all, sir, I would like on behalf of the U.S. Army to express the Army's profound regrets and respect and sympathy to NASA and to the courageous astronauts of the United States of America. I appreciate the opportunity to come before the committee and participate in this hearing on testing, but our distinguished congressional leader, Mr. Bennett, has asked about the tactics to start out with, and so I would like to cover a little bit of that, sir, and then if you want to probe further, General Burba is my expert on from the infantry center on that area and the like.

The first thing to know is that the mechanized and armored threat to our forces is significant, and we beat that threat with maneuver warfare, and leadership. There are two elements of maneuver warfare: fire suppression or killing, and maneuver, and that is true whether it is done at the squad level or the company level or the division level or the corps level. Maneuver warfare requires agile, mobile, protected and lethal forces. It has got to have around-the-clock capabilities to fight day and night. Its combined forces, as General Hollingsworth said to you, are infantry, armor, and artillery.

It is the equipment, the organization of the unit, the distinguished soldiers who serve in the unit and its leadership operating as a team. One-on-one duels are not the way to beat a threat that outnumbers you whether you are soldier to soldier or whether you are armored vehicle to armored vehicle or fighting vehicle or tank to tank.

Now the Bradley vehicle as a fighting vehicle has been a major addition and improvement of the mechanized infantry, and Mr. Battista has carried you through how it got to where it is. I remind you that it has on board a TOW missile system, an antitank killer, with a range of 3,750 meters. It kills Soviet tanks. It has a 25-millimeter stabilized gun which kills Soviet BMP's, their fighting vehicles, at ranges of 2,000 meters, and then it has a coaxial machinegun and firing port weapons in the Infantry Lighting Vehicle version. It is important to know that it is not a battlefield taxi, like the venerable M-113. It is a potent weapons platform, and so it contributes to the fire suppression business on the two aspects of maneuver warfare that I described, fire suppression on the one hand, and maneuver on the other.

To put this weapon in perspective, we used to have 370 M-113's, Armored Personnel Carriers, in the Third Infantry Division in Germany, and those were the principal vehicles for carrying mechanized squads. Now we have 370 Bradleys, which perform both the cavalry mission and the carrying of squads, and those 370 Bradleys carry 370 TOW launchers and 3,000 TOW missiles that were not carried in the M-113's. They kill Soviet tanks to 3,750 meters, depending on the terrain.

There is an obvious difference in the force survivability between the equipments. They also have 370 25-millimeter stabilized cannons, that can kill Soviet BMP's that are not located on M-113's, and they can also suppress those BMP's and suppress troops out to a distance of 2,000 meters with night sights that operate around the clock, and that permits continuous operations.

This weaponry then provides improved force survivability and kills more of the threat than the older equipped M-113's. Our computer models tell us we win with the Bradley and we lose with the M-113.

Fighting vehicles, or Bradleys, must keep up with and accompany Abrams tanks when traveling across country, just as General Hollingsworth indicated. In any given situation it may vary as to precisely where they are located, but it is not designed to operate like a tank, and it depends on the enemy's situation and the terrain, whether we are on the offense or the defense, which dictate its tactical usage.

The doctrine has been in place since 1978, but we continue to refine it. The more we use the fighting vehicle in Europe, as Colonel Foley did, or at the National Training Center, which is supervised by General Leland, the better we will become at using the full capabilities of this vehicle.

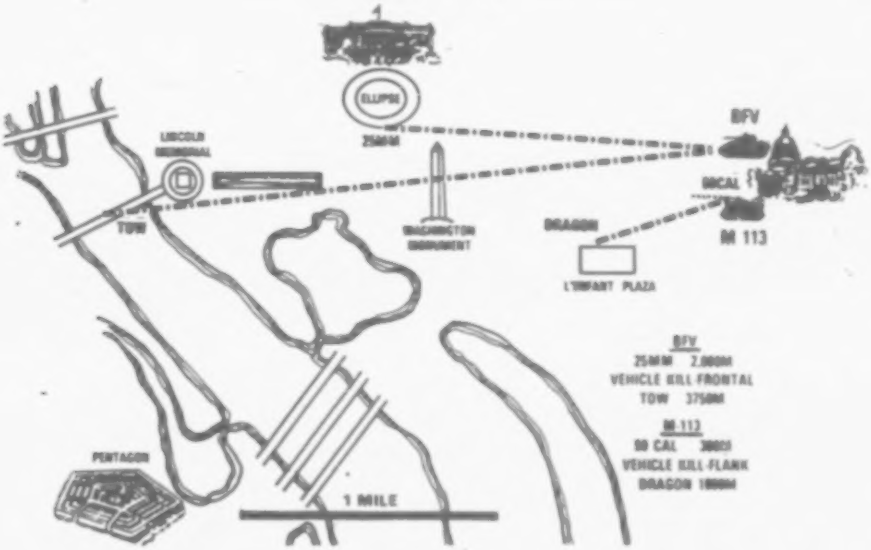
Force survivability, whether it is a foot soldier or a mechanized soldier, depends on agility, for one; whether he is on foot or in a vehicle, he has got to maybe dash across some open ground to reduce exposure. Survivability depends on armor, whether it be a flak vest for an individual, or laminate steel armor for a vehicle. It depends upon the use of terrain, crawling or keeping your vehicle in hull defilade so it is not spotted by the opposition and tactics of fire which are influenced by trained leaders. It depends upon day and night operations and it depends upon firepower. The best way to survive is to kill the other guy before he shoots you.

The fighting vehicle, the Bradley, is a quantum leap ahead of the M-113. This subcommittee saw its promise years ago to increase force survivability, and supported its research and development, and the Army appreciates that.

Now this hearing is on testing, and so I would like now to pass out the poopsheets and then I want you to uncover the first chart which I have up there.

MAXIMUM EFFECTIVE RANGES

M-113 – BFV


ELLIPSE
25MM
BFV
LINCOLN MEMORIAL
TOW
WASHINGTON MONUMENT
DRAGON
50CAL
M 113
L'ENFANT PLAZA
BFV
25MM 2,000M
VEHICLE KILL-FRONTAL
TOW 3750M
M-113
50 CAL 300M
VEHICLE KILL-FLANK
DRAGON 1000M
PENTAGON
1 MILE

The first thing I point out on this chart is simply the ranges that we are talking about, and the upper vehicle figure there shows a distance to the Ellipse from this Capitol building of 2,000 meters, and that is the effective range of the infantry fighting vehicle gun, the 25-millimeter, and the range of the TOW missile system is down to the bridge, that goes across at Memorial Bridge down there, so it is quite a different vehicle than the vehicle that is shown right below it, thc M-113, which has a .50 caliber machine gun which will kill a BMP out to 300 meters.

And it has a Dragon which can be fired from it, which may go out to a 1,000 meters, and even if the range between the opposition force and us is only half of that 3,750 meters, you get the notion that the TOW will shoot from here to the Washington Monument when its colleague, the M-113, will not go quite that far.

BFVS TESTING

	78	79	80	81	82	83	84	85	86
DT	✓	✓			✓	✓	✓		
PRODUCTION					✓	✓	✓	✓	✓
OT/FDTE	✓	✓	✓			✓			
VAPORIFICS							✓		
VULNERABILITY			✓					✓	✓

RESULTS

DT: TOTAL MILES 22,000 MMBF REQ'D 195
ACHIEVED 239
CURRENT 580

TOTAL ROUNDS FIRED TOW - 88 } MET ACCURACY
25MM - 27,282 } CRITERIA

PRODUCTION: TOTAL MILES 85,000 MMBF REQ'D 245
CURRENT 580

TOTAL ROUNDS FIRED TOW - 97 } MET ACCURACY
25MM - 102,102 } CRITERIA

OT: 78 - GUN SELECTION (25MM-HH VS FORD)
79 - OPERATIONAL EFFECTIVENESS (OT II) INFANTRY PLATOON
80 - CFV TESTING (FOT&E)
83 - BN LEVEL (FOT&E) 2 AD INFANTRY BATTALION - 6 MONTHS EVALUATION

The next chart covers testing, and we have talked about Bradley fighting vehicle testing, and this chart simply shows you that starting in 1978, we have had a series of development tests that have lasted several years, and production tests and operational testing and force development testing and vaporifics testing and now we are in the second, we have just completed the second series of vulnerability testings, and we are going to go to another one this year based upon the first one, because we are in complete agreement with Colonel Burton that that is what we ought to do.

Now I want you to circle 1979, if you will just point that out, on development testing. There were 251 different criteria tested in 1979 in development testing there, and if you will go down to production testing in 1983, the next one down; in 1983 there were only 321 items tested that year on this system. So the idea that this system has not been tested is not the case. And below that, I have just indicated a few little items which I thought you might be interested in.

In the development testing, we said we would like to have the mean miles between failure of 195 miles and the current is 580. So it says we do better in the field than we suspected we would do, and in the production tests we said we would like to have 245 mean miles between failure, and lo and behold, we are up to 580. So things are doing pretty well. And so on with the rest of those tests down there below that.

It simply points out, which I think is the purpose of the hearing to talk about: is testing adequate? That is debatable, but I am saying there is a lot of it.

RESULTS (CON'T)

VAPORIFICS:

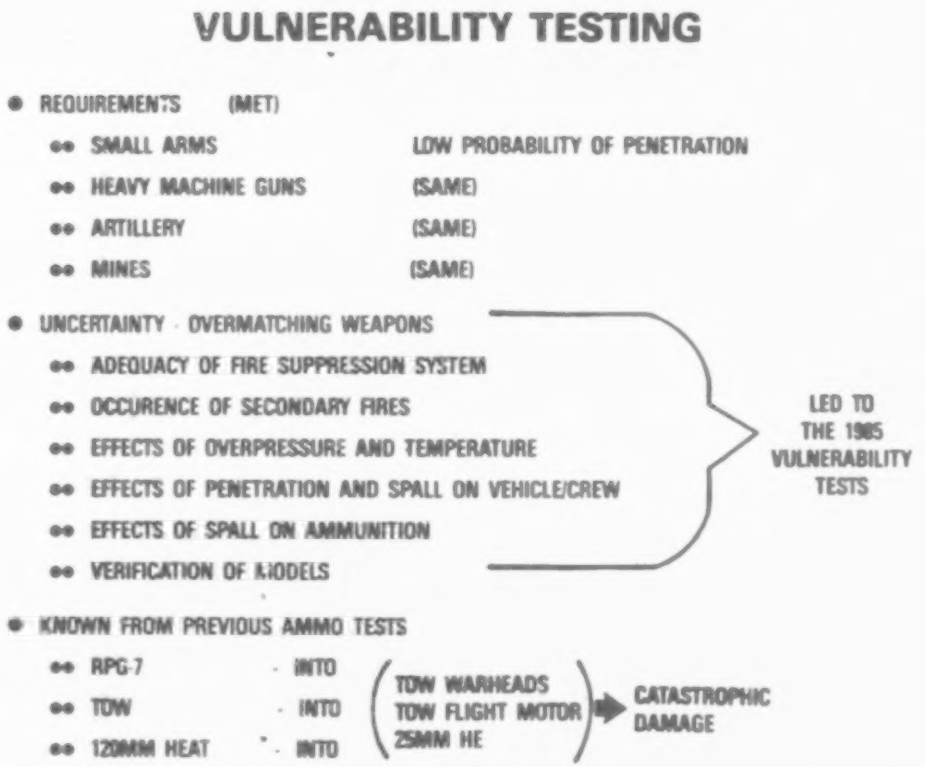
THREAT WEAPONS
- RPG-7
- TOW
- 105 MM HEAT

- OVERPRESSURES WERE NOT OF SUFFICIENT MAGNITUDE TO PRODUCE CASUALTIES
- TEMPERATURES DID NOT ENDURE LONG ENOUGH TO PRODUC SECOND DEGREE BURNS
- NO SIGNIFICANT CONCENTRATION OF NITROUS OXIDE, NITROGEN DIOXIDE

Now, on the next chart I would like to hit one which is a test we ran, which is on vaporifics, and threat weapons that were used in this particular test included the RPG-7, the TOW and the 105-millimeter HEAT round, high-explosive antitank. And we found out in those testings that the overpressures were not of significant magnitude to produce casualties. You understand there is a difference between our view of the test data and my colleague Colonel Burton's view of the test data, but the test data is open for inspection. And as Colonel Burton indicated, reasonable men can differ on the overpressure business.

The reason I bring that up is my colleague here on my right, General Wagner, as a result of being blown out of a vehicle through explosion in Vietnam, ruptured an eardrum, and he went on to win the Distinguished Service Cross later in that engagement. So some might call him a casualty and others might say he went ahead and fought because that was what was required at the moment. So we differ perhaps on the overpressure view of magnitude of casualties.

Temperatures were flash temperatures and did not endure long enough to produce burns, and we found no significant concentration of nitrous oxide or nitrogen dioxide as a result of the shell creating vaporifics as it passes through the external armor.



VULNERABILITY TESTING

- REQUIREMENTS (MET)
  - SMALL ARMS — LOW PROBABILITY OF PENETRATION
  - HEAVY MACHINE GUNS — (SAME)
  - ARTILLERY — (SAME)
  - MINES — (SAME)
- UNCERTAINTY - OVERMATCHING WEAPONS
  - ADEQUACY OF FIRE SUPPRESSION SYSTEM
  - OCCURENCE OF SECONDARY FIRES
  - EFFECTS OF OVERPRESSURE AND TEMPERATURE
  - EFFECTS OF PENETRATION AND SPALL ON VEHICLE/CREW
  - EFFECTS OF SPALL ON AMMUNITION
  - VERIFICATION OF MODELS

LED TO THE 1985 VULNERABILITY TESTS

- KNOWN FROM PREVIOUS AMMO TESTS
  - RPG-7 - INTO
  - TOW - INTO
  - 120MM HEAT - INTO

(TOW WARHEADS
TOW FLIGHT MOTOR
25MM HE) ➡ CATASTROPHIC DAMAGE

Now let's come to the subject at hand here, which is vulnerability testing. In the course of the Bradley qualifications on its original design, we said that it had to meet certain small arms, heavy machineguns, artillery and mine probabilities of penetration. I didn't put it on there, because it is classified. I will be happy to provide it in classified documentation to the committee if you would like.

Mr. McCurdy. We would like that.

[The following information was received for the record:]

Vulnerability Testing

This table presents a summary of the material need requirements and the results of testing of the IFV/CFV against the requirements criteria.

TABLE 1.—PROTECTION (U)

Factor	Required value	Result
Probability of no penetration by overheard artillery.	[Deleted]	[Deleted]
Probability of no penetration by 14.5mm AP of.	......do	......do
Probability of no rupture by 6 lbs of comp "B".	......do	......do

General THURMAN. OK. Now, in the case of those things, we essentially meet the requirements. We missed slightly on artillery, by about three hundredths of 1 percentage point. Now, sir, Mr. McCloskey, I cannot tell you about the 7.62. I just don't know that. I don't know whether you know about that, Lou, or not. That is something we will take on board. We just don't happen to know about it.

Mr. MCCLOSKEY. It is reported in the Jane's Defense weekly.

General WAGNER. During the earlier testing he referred to, we fired 228 shots of various types at the vehicle with larger calibers than that. We had [deleted] probability nothing was going to get inside the vehicle. There is a possibility that at some seam you might get some small fragments in, and we will look into that. It will not go through, not straight through the armor.

General THURMAN. And it has already been indicated in testimony today that 14.5 is the armor plate protection level at the moment.

Now I would like to jump down to the bottom of the chart, if you will just point that out, please, and you have it so you can read it better, because this is an area of what I would call the next process that ensued between the Department of the Army and Colonel Burton and his seniors. And that area has to do with the fact that we already knew—because we never designed the weapon—correction, never designed the vehicle—to withstand RPG-7, TOW, or 120-millimeter type HEAT rounds going into the stowed TOW warheads, the TOW flight motors or the 25-millimeter high-explosive rounds, because we already know that you get a catastrophic explosion if you do that.

That is back to General Hollingsworth's point that says some of these things we already know, and our view was to set aside the catastrophic tests, because we already knew that, and to proceed into the area of uncertainties, which are indicated in the middle of the chart. And I would suggest to you, sir, that that may be part of the negotiation process by which one comes to agreement as to what it is we should be shooting.

Mr. BENNETT. When you referred to him and his superiors, what is that group?

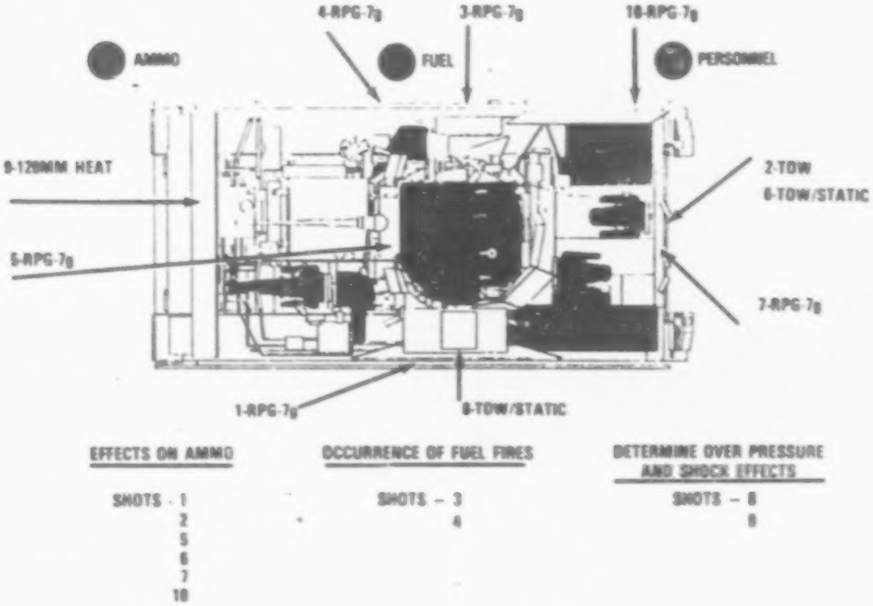
General THURMAN. No, I mean he works for the Under Secretary of Defense for Research and Engineering, I think that is right, so I am just saying he indicated——

Mr. BENNETT. The civilian channel of the Secretary of the Navy?

General THURMAN. No, no, Secretary of Defense.

Mr. BENNETT. Defense?

General THURMAN. Yes, sir. He is operating as Secretary of Defense. I am operating inside the Army, so all I am saying to you is there is some difference of opinion about that among analysts. Some analysts would say go out and fire that round that you already know will blow it away and see if it really will do that. And we say we already know it will do that, so therefore let's not waste a lot of time blowing it away. Let's waste—not waste—pardon—strike. Let us proceed on the basis of getting at the area of uncertainty, so we can help ourselves out. We already know we will blow it away here. So we looked at those particular items there, and they are all enumerated for you and they come up later, and that led to the 1985 vulnerability tests, and we worked on it.



SHOTS FIRED INTO BRADLEY (FULLY LOADED)

4-RPG-7g
3-RPG-7g
10-RPG-7g
AMMO
FUEL
PERSONNEL
9-120MM HEAT
5-RPG-7g
2-TOW
6-TOW/STATIC
7-RPG-7g
1-RPG-7g
8-TOW/STATIC
EFFECTS ON AMMO
SHOTS - 1
2
5
6
7
10
OCCURRENCE OF FUEL FIRES
SHOTS - 3
4
DETERMINE OVER PRESSURE AND SHOCK EFFECTS
SHOTS - 8
9

The next chart is the similar chart to the one you saw from Colonel Burton, and it is color coded to show where personnel are and where ammunitón is and where fuel is under the turret there, and you will notice that we shot all around this thing. We shot 120-millimeter rounds from the front, RPG rounds from the front. We shot RPG rounds from the side. We shot TOW's from the side. We shot TOW's from the other side or RPG's from the other side. We shot TOW's from the rear and RPG's from the rear.

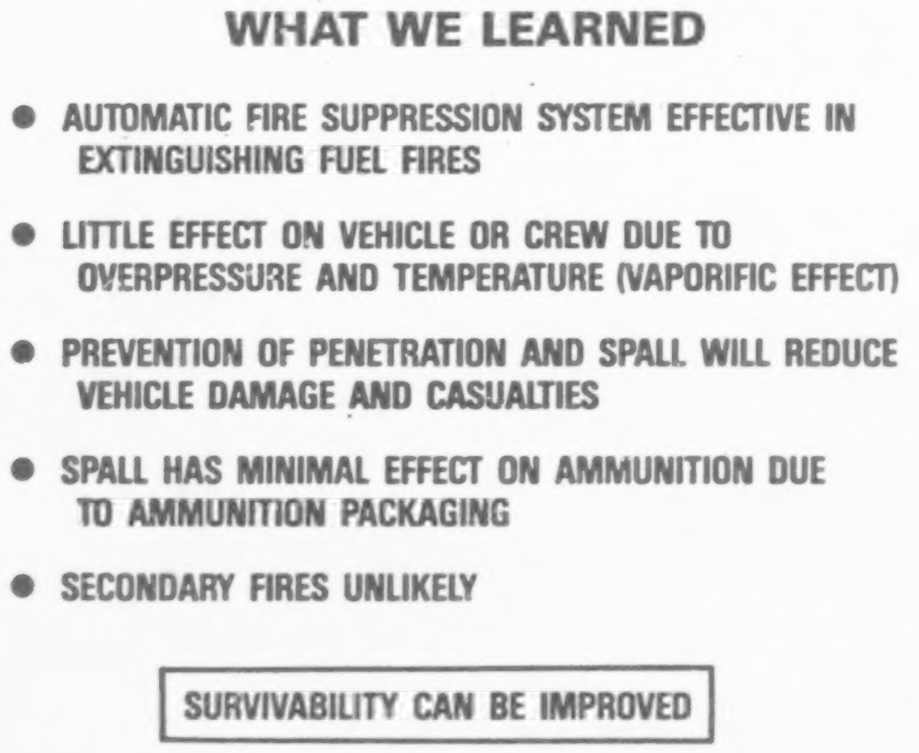
Now, we have talked about 10 shots, and that is what is on this chart. There actually were 68 tests, 33 of which were fired against live ammunition. This, or the 10 fully combat loaded, and therein, too, is another way in which we may disagree about the proceedings of the test. As Colonel Burton indicated to you on his charts, which show what is going on with testing componetry in aviation systems, where he described the test of an engine in an airplane taking it to destructive capabilities and the like. We proceeded on the basis that it was right from the start and shoot for understanding what it is you didn't know, and so we had some inert rounds in there when we did that, because if you have a catastrophic effect every time you shoot, then you will destroy the information contained in the data base from which you try to make judgments about whether you try to improve the packaging, improve the positioning or whatever else it is.

But there are debates between analysts as to how you should proceed with the order of march of testing. This is the way we did it. We shot 68 of them. The last 10 were fully loaded. We started on a building block basis of trying to build from what we knew through what we did not know in order to finally arrive at the test. We have negotiations going on right now on the order of march of the tests for the M-1 tank or the M-A1 tank, and these same sort of considerations will arise during that process. I think it is a totally legitimate operation as long as you get to the final point that you get enough data for everybody to look at.

There have been challenges about whether or not you should do static testing or dynamic testing or random testing. Does everybody understand what I mean by static or dynamic? That means I put the warhead maybe right up next to the vehicle and blow it off, that is a static test. If I stood off 1,000 meters and shot at it, I might shoot 100 times before I got exactly where I wanted to shoot at, and I will give you an example—the top right RPG test, which is fired from 35 meters away.

And because of the vagaries of the munitions being fired at it, it missed the launch motor in the TOW by about 3 inches, and so we have to replicate that kind of shot. So I am just saying that you've got to go to the mat with each other, which I think is a legitimate process, to make sure that the test regime is put up in an orderly process, and that we learn from it as opposed to just blowing the vehicles away.

So those are the shots all the way around the periphery of the vehicle, and that is what is in the report, including the other 58 shots that are in there. Now, what have we learned about it? That is on this chart.



WHAT WE LEARNED

- AUTOMATIC FIRE SUPPRESSION SYSTEM EFFECTIVE IN EXTINGUISHING FUEL FIRES
- LITTLE EFFECT ON VEHICLE OR CREW DUE TO OVERPRESSURE AND TEMPERATURE (VAPORIFIC EFFECT)
- PREVENTION OF PENETRATION AND SPALL WILL REDUCE VEHICLE DAMAGE AND CASUALTIES
- SPALL HAS MINIMAL EFFECT ON AMMUNITION DUE TO AMMUNITION PACKAGING
- SECONDARY FIRES UNLIKELY

SURVIVABILITY CAN BE IMPROVED

We have learned that the automatic fire suppression system is effective in extinguishing fuel fires. It is also true that we learned that the automatic fire suppression system goes off sometimes in error. Fortunately, it operates on the basis of it goes off when there may not be a fire, as opposed to not going off when there is a fire.

In other words, it is operating on the conservative side of things, but we are looking at how we can improve that to make it even more efficient. We found little effect on the vehicle or crew due to overpressure or temperature, although we have agreed to do further work, as Colonel Burton has indicated.

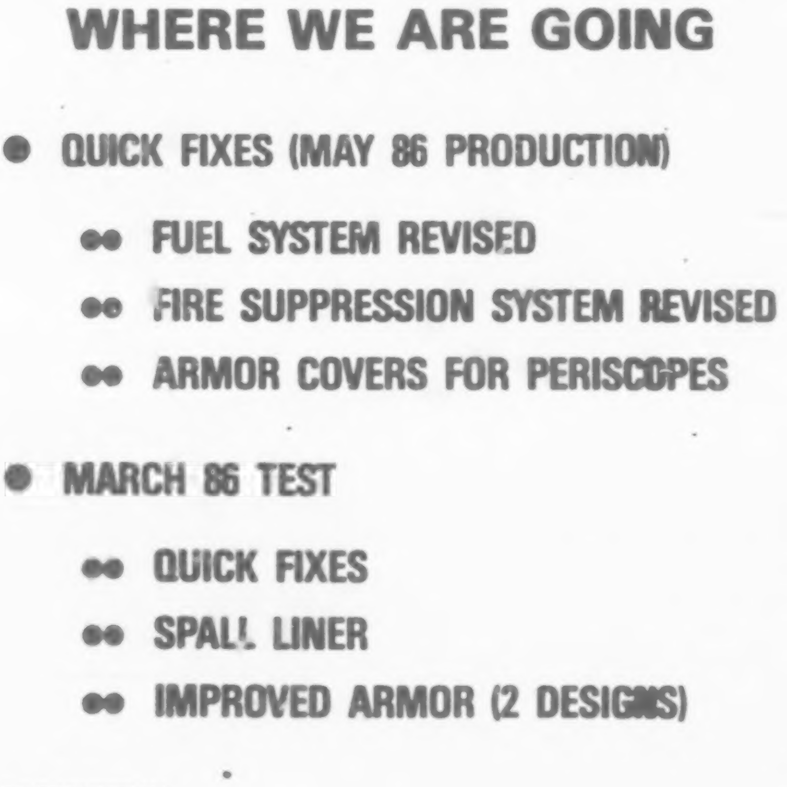
We have learned that the prevention of penetration and spall will reduce vehicle damage and casualties. Spall has minimal effect on ammunition due to its packaging. Secondary fires are unlikely, and most importantly we know that survivability can be improved.

Mr. Bennett. What is spall?

General Thurman. That is when the jet of a round hits the vehicle and the interior wall of that vehicle then crumbles and causes fragments to fly through the vehicle. Is that a reasonable explanation, Colonel?

Colonel Burton. Yes, sir.

General Thurman. There, that is where two analysts agree.



WHERE WE ARE GOING

- QUICK FIXES (MAY 86 PRODUCTION)
  - FUEL SYSTEM REVISED
  - FIRE SUPPRESSION SYSTEM REVISED
  - ARMOR COVERS FOR PERISCOPES
- MARCH 86 TEST
  - QUICK FIXES
  - SPALL LINER
  - IMPROVED ARMOR (2 DESIGNS)

Now the next chart—where are we going. We have got some quick fixes which we have determined that ought to be cut into production on how the fuel system should be operated. That simply says that we were pumping fuel from the bottom diesel tank to the top diesel tank, then letting gravity feed back down.

We reversed that. If I recall, suppression systems need to be revised. We are moving some of the sensors in order to reduce false alarm rate. We have put armored cover over periscopes. We are also looking at spall liners which then prohibit fragments from inside the vehicle spraying around and hitting other cables, other people or producing casualties and the like, and to improve some armor designs.

Sir, those are the charts that I have, and I would ask that you would do me the courtesy of including those in the record.

Mr. McCURDY. They will be admitted in the record. We appreciate your testimony.

General THURMAN. Let me just conclude, if I may, sir. Let me set the record straight on vulnerability testing as I see it as the Vice Chief of Staff of the U.S. Army and all these matters have to come to my desk.

The testing has been enormously useful. It has been responsibly done. It is done right. It has provoked discussions between interested analysts. The test design was developed jointly with the Department of Defense. It has been approved by them, and was conducted under their observation.

As Colonel Burton has indicated to you, he was invited to be a member of the Red Team that looked at all the data to make sure we are doing our job right. As a matter of fact, the GAO was there as well. The test report was put together with the full participation of the Office of the Under Secretary of Defense for Research and Development and Engineering.

No aspect of the tests or the report have been conducted without the oversight of the DOD testing community. It has been open and above board, and we can all agree on the data base, I think. But there are differences and those are in the interpretation of the test results.

I would submit to you that the analysts can disagree. Not only that, but they should, because it is in the disagreement that we develop what is the best interpretation of data. I will give you three areas of disagreement that we have right now.

We said that there are three casualties on shot No. 38, and the DOD analysts said there were five casualties. That would make a difference as to whether there were 61 or 63 casualties for the whole test. That has to do with whether or not people took a quick action drill and got out of the vehicle or stayed in and watched it burn. I would submit to you that any guy that has been in there and sees it burn, would get out. There is an honest interpretation of data about that.

Analysts said ruptured eardrums produce casualties. We say no. We have General Wagner as a witness that he continued to fight even though he had his ear blown away, eardrum that is, and the OSD analysts said exposure to Lalon fire extinguishers may produce a toxic effect on the crew. The Army says no. The Army Surgeon General says no. It is used on submarines. Underwriters' Laboratories endorses it. We will be happy to hear from the Assistant Secretary of Defense for Health on this area, and we will continue to resolve the issue, if there is an issue about that.

Analysts can also disagree on the product improvements to be made. I think that we can uniformly agree that improvements ought to be made. Product improvement is the norm. I think Mr. Battista showed that in terms of saying that you are trying to make evolutionary improvements, if you discover weaknesses or whatever, you need to make technological improvements to the very best of your ability. That is certainly nothing new to this committee.

You have vigorously supported product improvement. The Congress last year approved money for R&D. I am sure this committee had a hand in it. Some $614.2 million for RDT&E for product improvement proposals [PIPS] mods. In that was about $23.3 million for Bradley's. When we send a budget up for R&D in 1987, we will send you a budget request for $762.8 million for RDT&E PIPS and mods. You supported product improvement for the M-1 tank. It is more survivable. It is now called the M-1A1, with its 120 millimeter gun. You have supported these product improvements for the Hawk missiles. There are versions of F-4 aircraft that run through the alphabet.

I was at an air base in Europe last week, and they told me about the arrival of a new F-16 product improvement. So product improvement is part of the business. We understand that. We need your continuing support for the product improvement system.

I would like to remind this committee that the services and the Congress have worked together to continue the production of vital systems while coming to an agreement on cutting in new product improvements, and the retrofitting of older models. Just like you continued production of the world's best tank, the M-1, while bringing on the new world's best tank, the M-1A1 Abrams with its 120-millimeter gun.

Like General Hollingsworth says, we need block modernization, but you don't want to stop what you have got while you are improving and making block modernization, so it is with the Bradley improvement. Improvements we bring to you for incorporation in the product improved Bradley need to be recognized by you and approved by you, and we vitally need sustained production for this fighting vehicle because it permits us to win. When you approve the product improvements that we may bring to you, it will do even better.

So, thank you very much for letting me come before the committee. We will be happy to entertain any of your questions.

Mr. McCLOSKEY. I appreciate your detailed justification of the Bradley testing, sir. I wonder if those same standards were in effect during the very controversial DIVAD tests in which it was alleged very unrealistic conditions and fewer augmentation devices used before the radar could engage the target.

General THURMAN. Well, I may ask Lou to help me out.

General WAGNER. I am surprised with Mr. Battista's statement that we hid that fact because I happened to be the individual before the Procurement Subcommittee of the HASC who testified exactly how that test was run. I laid out all of the details, what I considered the problems were with that test. I also answered that same question for the press. So I am a little surprised that we are accused of hiding anything.

I think we laid out all our data on that test. It was controversial within the Department of the Army and OSD, and with other adversaries. We didn't hide any of the data.

Mr. McCloskey. I didn't accuse you of hiding anything, General. What I did say was that it has been alleged that—or is it not true that there were unrealistic conditions involved and there were four augmentation devices which were normally not available used before the radar engaged the targets.

[Committee note.—There is no record in the committee of any information that is alleged to have been provided on this particular Divad test.]

General Thurman. I believe that an attempt was made to try to place the device on that particular helicopter because it was not a Soviet helicopter, because we have a very difficult time, as Colonel Burton says, getting a lot of them.

We tried to make it as near a Soviet helicopter as our intelligence permitted us to do. That is why we used augmentation devices. That is my understanding of it.

General Wagner. It was the belief of the tester that it did not give it any more signature than a Soviet helicopter. We questioned that within the Army when we saw the test results, and we reported it.

Mr. McCurdy. I would suggest we do this in order to—the Chair has a couple of questions, and then we will proceed to the next ranking member. There are a number of people that want to get their time, and we have other members.

In the interest of time, I think we could perhaps proceed a little more smoothly here before we get interruptions.

General, there are a couple of things there. This is a hearing on testing.

General Thurman. Yes, sir.

Mr. McCurdy. Some people have raised some questions about it. I think this subcommittee has complete jurisdiction over this area. Some members sit on other subcommittees that have other areas of jurisdiction. Each of us are full members of full committees. I can assure you we are all interested in not only the testing, but the results, and I was curious about the testing.

You had one chart, if you could put the chart back up, where it had the time line from 1978 to 1986.

General Thurman. Yes, sir.

BFVS TESTING

	78	79	80	81	82	83	84	85	86
DT	✓	✓			✓	✓	✓		
PRODUCTION					✓	✓	✓	✓	✓
OT/FOTE	✓	✓	✓			✓			
VAPORIFICS							✓		
VULNERABILITY			✓					✓	✓

RESULTS

DT: TOTAL MILES 22,000 MMBF REQ'D 195
ACHIEVED 289
CURRENT 580

TOTAL ROUNDS FIRED TOW - 88 } MET ACCURACY
25MM - 27,382 } CRITERIA

PRODUCTION: TOTAL MILES 85,000 MMBF REQ'D 245
CURRENT 580

TOTAL ROUNDS FIRED TOW - 97 } MET ACCURACY
25MM - 102,102 } CRITERIA

OT: 78 - GUN SELECTION (25MM-HHI VS FORD)
79 - OPERATIONAL EFFECTIVENESS (OT II) INFANTRY PLATOON
80 - CFV TESTING (FOT&E)
83 - BN LEVEL (FOT&E) 2 AD INFANTRY BATTALION _ 6 MONTHS EVALUATION

Mr. McCURDY. In 1980 is when you had your first vulnerability test. At that time, was it again a clean bill of health? Was that preproduction phase? What stage of production were we at that time?

General THURMAN. First of all, you have to set down some design requirements. There are tradeoffs in everything, and so, when you look at a particular vehicle, whether it is a tank or an armored personnel carrier, fighting vehicle, whatever it may be, aircraft, you name it, you are in the business of trading off weight, space, rounds to be carried, crew to be carried, agility, speed, maneuverability, all those things that interact, then you try to come to grips with the vehicle that will meet your need.

In this case, we said it must be able to withstand and outgun the then-Soviet BMP, because it is liable to come up against that. So that, for example, puts down the requirement for 14.7 as being the heavy machinegun which they had at that particular time.

It is no secret that they are up-gunning their weapon in order to try to get at that. We will have to take some steps about that which would be a normal block product improvement.

Mr. McCURDY. I am going to defer any further questions, if I could. I am going to defer any questions I have on the Bradley, to some of the other members who are probably better versed, but I wanted to ask one last question, that is a statement that Colonel Burton made, that has appeared it is not new, it is, and one that a number of us have been considering, I think it was in the book, The Pentagon and the Art of War, that there was some type of independent testing doing away with systems command and all different kinds of changes.

I want to ask you specifically the question, do you agree or disagree with a formation of an independent testing unit within the Department of Defense, other—more than what we have now, that would do the testing independent of the Army?

General THURMAN. I would say that the Army does pretty good testing. I don't have any trouble dealing with the independent agencies, Department of Defense, if the Secretary of Defense wishes to organize that way. I have an independent testing organization that works for me.

Quite often, they come in and tell me stuff I don't like to hear, but I respect them because they bring in the information. They say, look, there is a deficiency on this item of equipment that must be corrected, and that major general is doing his job pretty well; we just recommended him for promotion.

Mr. MCCURDY. Let me ask it in another way. Do you believe only the Army can conduct the tests that would—is there something unique about the Army's ability to conduct tests that an independent agency of the Department of Defense would not be able to perform?

General THURMAN. There is nothing unique about that.

Mr. MCCURDY. Thank you.

Mr. McCloskey.

Mr. MCCLOSKEY. I would like to ask Mr. Battista to elaborate on his testimony earlier about the DIVAD, and perhaps comment on the panel's comment on the DIVAD in reply to my question.

Mr. BATTISTA. If I recall, I would not like to be contentious with General Thurman or General Wagner. In many cases, they have the same problem we do getting the right data from different folks in the organization.

I say—however, I have to digress about the assessment that the augmentation of that helicopter during the test was to simulate the cross section of a Soviet helicopter.

Cross section was not an issue, the principal issue was ascertaining whether or not you could pick that target out of ground clutter, and the fact that you added to the fuselage and didn't work the radar, didn't still acquire it, then led to the second step to add forward augmentations device around the mass, which in effect generated Doppler that wouldn't normally exist.

In other words, you were putting on that helicopter an augmentation to generate a phenomenon that you wouldn't see. Helicopters generally allows you Dopplers, and I can say that you could get any radar expert in the country, and I would be most happy to sit down to the table and go through this and in no way will you simulate a cross section of Soviet helicopters, by the addition of Lunaberg lens in that configuration.

Mr. MCCLOSKEY. General, would you have a comment?

General THURMAN. I yield to Mr. Battista. He is an expert in that stuff. I am not.

General WAGNER. I agree with him 100 percent. That is the reason I said I wouldn't have tested it that way when I testified over here and we didn't consider it very valid data. The tester said that was a way to do it, it didn't look that good to us. That is what we told you.

Mr. **McCloskey**. Thank you.

Mr. **Darden**. Thank you. General Thurman, I realize it is getting late in the day. I wanted to cover several questions about the Bradley Fighting Vehicle with you and members of your group.

If I recall, Colonel Foley, it is my understand that you commanded M-113 units and Bradley Fighting Vehicle units in Europe. Why was not the M-113 adequate for the job?

Colonel **Foley**. That is correct, I did in fact command a M-113 battalion from 1976 to 1978 in Europe, and most recently commanded a brigade of Abrams and Bradleys in Europe.

I think the best way to answer that is for me to sort of set the tone on what the threat is, because I think that is the nature of, at least one of the reasons why we need this Bradley Fighting Vehicle.

The threat that exists across the border; if they in fact attack across the border, I as a brigade commander had responsibility to go up and defend a General Defense Plan [GDP] sector. I was assigned a sector of that border.

It was my function, my obligation to defend that sector. I think I should also state that as a part of a larger corps, GDP plan which is in effect. That plan would estimate massive numbers of Soviet vehicles, threat vehicles coming into the area, because it is very terrain-dependent.

So many numbers of vehicles could come on a piece of terrain along certain avenues of approach. I want to assure you we have preplanned fires and battle areas and battle books down supporting platoon leaders and a lot of other supporting arms were available for us to do this battle.

I know I may be elongating the answer to your question, but I think it is necessary to show you the total force aspect of this. In the supporting arms, you have engineering obstacles, a mine field, we also have the third dimension, TOW armed Cobra, helicopters, Air Force close air support, and artillery.

The employment of the Bradley on the European battlefield today takes into account the nature of the type threat vehicles that we come up against and the echelon of forces that we might have to go up against.

So what we must have then is a combined arms concept which fits under the title of maneuverable warfare, that is kind of warfare which we are up against on the European battlefield.

When we take the Bradley, we don't take it alone, it must be on the ground in the combat arms combined with Abrams tank.

At the battalion task force level, we combine Abrams and Bradley, same leadership, same unit we cross attach, might be two tank companies, two Bradley companies.

We do the same thing with company teams, so you may have a company team of two tank platoons and a Bradley platoon. So, in fact, you have Bradley platoons and tank platoons fighting together under the same leadership.

The key to this is that they have a rare complementary capability. For example, the Bradley, because of the firepower that it has, it has a tremendous capability for suppressive fires. It has a 25-millimeter cannon, which can fire either high explosive antitank or armor-piercing rounds, either one.

It has coaxial machineguns, it has a TOW missile which can provide overwatch. Now, what that does is that it allows an—at great distances, it allows us to use the kinds of things that we need to use, the tactics we need to use, to ensure that we have defense and department mobile reserves that kind of thing.

We can extend the ranges out so that we can, as those forces would be coming into my sector as the brigade commander kills tanks, at a range 3,700 meters, we can use the 25-millimeter cannon to strip off, and what all that does is, it tends to deceive the enemy as to the true location of our forces, where we are located, it delays them, it makes them deploy.

It forces a situation where maybe their tanks now are bare of their reconnaissance elements and it attrites the total force. So when that force finally gets into where our locations are we have a better capability to fight them, and therein is where the tank comes.

The Abrams main battle tank provides that tank combat up to about 2,000 meters plus it kills the BMP also, but it is also looking for the second echelon punch, so they work together as within the task force on very fluid, very high mobile battlefield in Europe.

If I can give one example of the entire task force in the defense array, and yet, we look at a lot of offensive maneuvers. For example, the brigade located on a piece of terrain may want to move from one piece of terrain to the next, from one defense position to another position.

Very highly mobile, with a tremendous cross-country capability to shoot on the move.

A 25-millimeter cannon, which can shoot out extended ranges to 2,000 meters, so that as you cross terrain, hopefully you would be following the terrain, so you would get the least exposure time as possible.

What you want to do is make a dash, so you have tremendous agility, acceleration, and speed. Meanwhile, you have a coaxial 25-millimeter cannon, which always stays on target, no matter what your suspension system is doing, and it is firing.

You are also buttoned up, totally protected while you are moving from one point to another. You also have an on-board generator which creates smoke, and as you are moving, you can be using that smokescreen to protect yourself.

The enemy won't see you through the smokescreen. Because of your thermal night sight, you can see through the smokescreen. You can fire at the enemy vehicles.

Mr. **Darden**. How effective are these night sights?

Colonel **Foley**. The effectiveness of the night sights would, you could look at it from the standpoint of limited visibility, through fog, or smoke, or just plain darkness, and it has a varied effect based upon its thermally energized—it is based upon the—of course, the distance to the target, the heat of the target, the source.

Mr. **Darden**. Give me some parameters. How far could you kill a target?

General **Thurman**. Out to the range of the TOW missile system, 3,750 meters for operations. You can't detect targets beyond that.

Mr. **Darden**. Using the night sight?

General **Thurman**. Yes, sir.

General **Leland**. My son is a tank gunner and maybe the most effective way to say it is an awful lot of soldiers use it in the daytime as well as night. They prefer it over the daylight sight.

General **Burba**. It is one of the major advantages that we have over the Soviets, is that thermal sight, both the Abrams and the Bradley. It is almost an overriding advantage that we have over them. It is one of the reasons why the vehicle is built the way it is, and why suddenly it gets so high.

Mobile, adding firepower and fire control systems gives it those firepower and mobility advantages that give us these overriding enhancements over the Soviet vehicles.

General **Thurman**. We have a gunner who may want to correct all of us here. Speak up back there.

Sergeant **Hermann**. I am a platoon leader. My company has also trained me as a Bradley master gunner, and the night sight works well, up to ranges as the General said, past 3,000 meters if the heat source is there. You can get—pick it up, only problem you would have is the exact nomenclature of vehicle you would shoot.

Mr. **Darden**. Do you ever use the night sight during the day?

Sergeant **Hermann**. Yes, sir.

Mr. **Darden**. Why is that?

Sergeant **Hermann**. You will have a more reliable source. The way we are trained, we know that there are not going to be coming down the road, wide out in the open in the wood line if they are going to use their cover techniques, sometimes we can't pick them up, and we sometimes—that heat source will pick them up.

Mr. **Darden**. You seem to be sold on the Bradley Fighting Vehicle. Do you feel comfortable going to combat with it?

Sergeant **Hermann**. Yes, sir, I do. I have been with it for 2 years. I have been lucky enough to be trained as a master gunner. Right now, I am acting platoon leader.

Colonel **Foley**. If I could finish that one, the example I was giving you, and then go into the M-113. If I were to try to do that same thing bound from that one terrain feature to the other, first of all, that M-113 can't fire on the move.

I suppose you could try to fire the .50-caliber machinegun on the move. If you do that, of course, you are in the turret unprotected, and many of the leaders, of course, are the ones that would be up there firing the machinegun.

There are no other suppressive fires. So, if you are going to move buttoned up across the battlefield, you don't have any other capability to fire.

Mr. **Darden**. You say you can't fire the M-113 on the move? You can the Bradley?

Colonel **Foley**. Yes, sir, you could, but if you were going to do that, in a combat environment, you are extremely vulnerable sitting up there in the hatch trying to fire it, plus it is not very accurate trying to fire it on the move, because it is a free gun.

General **Thurman**. Not stabilized.

General **Burba**. You will see as much dirt as you will the target, and as you see the target, it will be going up and down in every longitudinal direction.

General THURMAN. Preproduction, I believe, right. It had four criteria to meet which were on the next chart, on chart No. four, which had to do with, did it meet small arms, 14.7 artillery and mines and the like? Those are the top four up there. That is when that was done in 1980. Those vulnerabilities were done then.

Mr. MCCURDY. That is a preproduction phase?

General THURMAN. Yes, sir.

Mr. MCCURDY. Then the next testing is done in 1985?

General THURMAN. Correct.

Mr. MCCURDY. But that is at a production phase of some 2,000 or so?

General THURMAN. Yes.

Mr. MCCURDY. Roughly?

General THURMAN. Yes, sir.

Mr. MCCURDY. Now, so I am assuming that in 1980 in the preproduction phase that there is a go ahead on the design and the components that resulted in the production.

General THURMAN. Correct.

Mr. MCCURDY. Without further testing?

General THURMAN. Of that, of that particular feature.

Mr. MCCURDY. That is correct. We are just talking about vulnerability at this point.

General THURMAN. Yes, sir.

Mr. MCCURDY. Can you tell me why the tests were resumed in 1985 and was that a normal sequence of events?

General THURMAN. No, I think the idea, as has been demonstrated by the testimony of Colonel Burton, is that the Department of Defense decided it wanted to enter into the full "OP" testing, including overmatching weaponry, and that is what we are doing. So it met the design criteria at the time and the design criteria had those four features to it on small arms, heavy machineguns, artillery and mines. It did not say that it was necessary to hit it with a—we gave the fact it would be hit with RPG-7. So vulnerability testing that has come along in 1985, I think it is a logical outgrowth of saying you want to get into the full "OP" live fire testing business. We have complied with that, and I think we have met the spirit of that requirement as well as the actuality.

General WAGNER. Also since that time we have gotten even smarter about what we can do in the protection level. So it makes a lot of sense to find out if you can protect it to a higher level today.

Mr. MCCURDY. The point that you are making is, I think you are making, is that up until 1985 there was not a requirement for the uploaded test and that this occurred not just for the Bradley or is it for across-the-board type live testing?

General THURMAN. We designed——

Mr. MCCURDY. Testing recommended specifically because of the alleged defect in the Bradley or was it because——

General THURMAN. No, it was not. It was not an alleged defect in the Bradley in any way. The Department of Defense decided, and we agreed with, the business of going to test at even greater design than was done in production or preproduction, so we agreed with that and we started doing that. This happens to be the first one we put through the ringer.

Mr. McCurdy. Were any of those tests—can you envision—would you give us the basis, did any of those tests fail, can prove fatal to the design or production or this? In other words, if on vulnerability in RPG, well, probably 105 as opposed to RPG-7 penetrates, if that had been fatal to the design or the decision to go to production?

General Thurman. No.

Mr. McCurdy. What criteria is there for—what point in time can you determine whether there is a fatal flaw?

Mr. Darden. The ones you lock in on the target with the Bradley then it doesn't make any difference how much movement there?

General Burba. that is one of the reasons the vehicle is so high. It allows you to do that. It gives you the suspension and the other fire control technologies that will allow that to occur.

Again, it is a major overriding advantage that we have, not withstanding that it makes the vehicle a little bit higher.

Mr. Price. Mr. Bennett.

Mr. Bennett. I will try to be brief because time is going by.

You have described, several of you, the tactics for this vehicle. I would like to clarify it though, and get a repetitive statement from you to the extent I would like to know do you plan to use this vehicle in combat stations in advance of tanks or close to tanks or line tanks?

General Thurman. Let me ask the doctrinaire of the Army to tell you that.

General Burba. Let me just spinoff on General Hollingsworth. He said you would use it differently under different combat situations, and let me be a little bit more precise.

In our doctrine we elaborate on three combat situations, light resistance, medium resistance, and heavy resistance.

Mr. Bennett. Light resistance?

General Burba. Let me explain, sir. Light resistance would be probably a platoon system element, four tanks, or four fighting vehicles, four mechanized carriers, no combined Army's synergism at work, just four vehicles of a like kind.

This would probably be in hasty positions. In that type of situation, which would occur after you have broken through the main line of resistance, and you are exploiting, or you are pursuing, Bradley's could operate with tanks, never in front of tanks, in the infantry role, but they could be operating with them. In medium resistance situations, what you would probably have a company size element, say 15 tanks, combination of tanks, fighting vehicles or armored personnel carriers that would have combined arms support, artillery, and whatever, with hasty positions, individual fox holes, but the vehicles would not be in covered positions, that is a little bit more resistance.

We don't like to take the Bradleys up as far, don't really need to, because again your weapons systems reach out much further now than the M-113, so we would hold them back in probably a close overwatch position, some 500 to 1,000 meters back.

The tank would use covered and concealed routes to eliminate that resistance. Once they break the tactical integrity of that resistance, then the Bradley would come forward again.

In the heavy resistance situation you would probably be up against a battalion size force, 50 to 60 armored vehicles of one nature or another. They would be in entrenchments, both the vehicles and the dismounted soldiers, and you would have the complete combined army's synergism at work, engineers, digging obstacles, minefields, entrenchments, as I have indicated, and other type obstacle systems, and you would have possibly aviation support.

Heavy resistance is a very dicey situation. Not even tanks can attack with impunity against such entrenchments. Neither can the Bradley.

They both stay in overwatch, and we use dismounted infantrymen to go covered, concealed routes which they can do very easily through——

Mr. BENNETT. Do they dismount from the Bradley or not?

General BURBA. Yes, sir, under that situation in all likelihood you would always dismount Bradleys. It is very difficult to go straight into an entrenched overwhelming force that might know that you are coming.

They have the full complement of combined armed support, so dismounted infantry goes into what we call close overwatch or breaching action. The tanks very quickly pick up on the initial breach, and exploit, cover the soldiers, and then the rest of the tank and Bradley force punch through and then you are back into an either medium or light resistance situation.

So what General Hollingsworth said is true. You will see all sorts of situations develop. Within one battalion task force sector you may see light resistance, one small battle, you will see another battle with medium resistance, and a heavy resistance. In maneuver warfare you have many independent but interrelated small fire fights going on all the time.

In each case the Bradley would probably be used differently.

Now, most people when they think of tank war, formally think of the heavy resistance situation, where you are really slugging it out out in a major engagement, and we don't use Bradley, nor do we use tanks up front trying to go straight into that type of an engagement area. You are very vulnerable. You have got to use tactics to survive, so use your dismounted infantrymen, give you a breach, get suppression, get attrition down of these vehicles. Then you can punch through with tanks and Bradleys right behind them again and then you are back into a fluid situation, Bradleys and tanks working together, so it does depend on the tactical situation.

Mr. BENNETT. I am very interested if you want to add anything to what you have said in the record. I have heard confusing ideas. I realize any particular commander might differ just as they did in the cavalry in the past and everything else. Different commanding officers have different views as to how they are going to use people, but your overall discussion has been helpful.

[The following information was received for the record:]

THE BRADLEY FIGHTING VEHICLE DOCTRINE

General BURBA. Defeat of an enemy force, superior in numbers and equipped with weapons of equivalent technology, must be accomplished through maneuver warfare. The essence of such warfare embraces both the avoidance of major frontal engagements where enemy combat power prevails and the initiation of friendly attacks along lines of least expectation and resistance where the enemy's combat power is emasculated and ours is substantially enhanced. At the lowest levels, these tactics are referred to as fire and movement, at higher levels as firepower and maneuver, and at the highest levels as maneuver warfare.

To accomplish these indirect tactics, infantry-heavy forces fix or at least control the movement of enemy first echelon forces while artillery, air, and engineer units support them and freeze second echelon forces through fire interdiction and barrier operations. While the enemy's attention is on these fixing, interdiction, and barrier actions, tank heavy units, accompanied by protecting infantry, attack his vulnerable flanks and rear before he can react. Such operations unhinge enemy tactical integrity and provide opportunities for attack deep in the enemy's rear by division and corps-constituted operational reserves.

A more precise snapshot of the maneuver aspects of these combined arms operations displays the enemy's target acquisition and weapons systems, offensive formations, and defensive entrenchments facing in one direction, and friendly attacks emanating from a different direction, normally the flank or rear. Such attacks avoid the enemy's superior strength while concentrating friendly strength against his weaknesses. Flank and rear attacks quickly lead to destruction or paralysis of the enemy's command posts and his artillery, aviation, engineer, and logistical support units. Without having taken on the enemy's superior combat force, friendly forces defeat him within by de-synchronizing his command and control and depriving his combat forces of critical firepower, maneuver, and logistical support.

As indicated, there are two maneuver force underpinnings that allow these tactics to succeed. First, the enemy's first echelon force movement must be fixed or at least controlled. Secondly, an agile maneuver force must be able to react more quickly than the enemy. The tank is clearly the preeminent weapons and mobility system for the maneuver force and it has always performed its role well. The weapons of the infantry's M-113 carrier and organic troops have neither the range nor lethality to perform the fixing function. Previously, tanks had to be used to execute this role and, thus, deprived of the role that they do best—maneuver. When tanks were previously used to fix the enemy, our forces were deprived of adequate maneuver elements and were forced into attrition warfare. The enemy's superior numbers normally presented him victory. Tank-heavy forces are too precious to be used as the predominant fixing force.

With the Bradley Infantry Fighting Vehicle, the infantry now has the vehicle it needs to fix the enemy, freeing tank-heavy forces for maneuver and, thus, providing the Army with the opportunity to conduct maneuver warfare. Not only can the Bradley's TOW missiles destroy enemy tanks, its 25-mm Bushmaster can destroy or suppress its Soviet counterpart, the BMP, and its coaxial machinegun can destroy or suppress dismounted infantry. The range of these Bradley weapons systems also allows the infantry to occupy long range, dispersed, mutually supporting positions, arrayed in depth, or on flanks along likely avenues of approach throughout the battle area. These positions deny the enemy complete use of his combat power by avoiding the directional orientation of his target acquisition equipment and weapons systems, and brings the majority of our forces' combat power to bear on his weaknesses, the sides of his tanks, and the flanks of his formations.

There are other premiums. The range of the Bradley's weapons systems allows an extension of the umbilical cord between the infantry vehicles and the dismounted elements. Previously, the location of both the vehicles and dismounted element was a compromise between positions that would optimize each element: the positions neither completely favored the dismount element nor the vehicles. Now with the longer range weapons, vehicle dash speed, and improved armament and optics, both the vehicles and dismounted element can be placed in optimized positions. Furthermore, such positional flexibility allows dismounted infantry the opportunity for infiltration and ambush attacks and reverse slope and checkerboard defenses, "miss direction" operations implicit in maneuver warfare.

Once the enemy force's movement is either fixed or controlled, a tank-heavy force can quickly maneuver into its flanks and rear. The Bradley infantry also has important roles with the tanks during this maneuver. It performs reconnaissance and counterreconnaissance, clears restricted terrain, protects at night, and breaches obstacles. Further, it mops up by-passed enemy, seizes key terrain to maintain the momentum of the tank attack, and importantly, destroys and suppresses enemy antitank weapons. Tanks alone are unable to perform these roles. The M-113 armored personnel carrier's lack of cross country speed and agility prevents it from accompanying the tanks, and its lack of mounted firepower to destroy enemy tanks and fighting vehicles compromises the maneuver force. Bradley infantry can effectively fight tanks, BMPs, and other armored vehicles, thus allowing brigade and battalion commanders to mass tanks for maneuver. As can be seen, Bradley infantry is as critical to the maneuver elements as it is to the fixing force.

Concern has been expressed that Bradley dismounted strength has been reduced to unacceptable levels that prevent it from performing the roles just discussed. Even when the M-113 personnel carrier was structured with an eleven (11) man squad, there were only 5 maneuver soldiers. Five members of the squad were dismounted to perform fire support because the one gunner with the 50 caliber machinegun could not perform that role without substantial reinforcement. The current Bradley squad with its six dismounted soldiers dedicated to maneuver can perform infantry dismount roles as well, if not better, than the five in the larger M-113 infantry squad.

Other concerns have been expressed relative to the Bradley's capability to stay up with tanks during maneuver. (Because of its light armor protection). An analogy: the F15 aircraft is highly vulnerable to any ordnance that hits it; however, it derives its survivability from its speed, agility, and tactical employment. The same situation applies to the Bradley. During light resistance against an enemy force such as a mechanized or tank platoon (3 or 4 vehicles) that is not dug in nor possesses combined arms support, the Bradley can fight in the same combat formation with the tank.

During a medium resistance situation, where the friendly force is faced with a company-sized element (10-15 vehicles) with combined arms elements supporting whose dismounted elements are in a hastily dug position, the Bradley is able to perform overwatch missions, suppressing and destroying targets to allow the tanks to maneuver to break the integrity of the enemy's tactical dispositions. Once this is accomplished, the Bradleys can then join the tanks and continue the fight in the same combat formation. Against heavy resistance, where a battalion sized enemy force (40-50 vehicles) is echeloned in depth, with security to the front, with combined arms support, and with all vehicles and infantry in dug-in positions, both the Bradley and the tanks will go into overwatch positions. From these positions the tanks and Bradleys destroy and suppress the enemy to allow dismounted infantry from the Bradleys to move forward to conduct close overwatch and assault breaching missions. Once the assault breach is accomplished, tanks can move forward, exploit the breach, hold the shoulders, and allow follow-on tank and Bradley combat formations to continue the attack.

In a battalion task force area many independent but related firefights occur. In some of these fights, Bradleys will be fighting within the same battle positions or formations with tanks. In other situations, they will be in long overwatch with or without the tanks. In each situation, conditions are dynamic and the Bradleys move forward or remain in defilade as the situation dictates. This is the nature of combined arms tactics that are subscribed to by infantry and tank forces throughout the world. Importantly, the Bradley can perform in all situations in a manner relatively impervious to artillery fire, because its ammunition and fuel are stored internally. Externally stored fuel and ammunition might increase survivability somewhat from direct fire interdiction but would degrade the vehicle's enormously important firepower and mobility functions considerably during enemy artillery engagements (which will be formidable and frequently experienced).

To summarize, the defeat of an overwhelming echeloned force must be accomplished through maneuver warfare which, in conjunction with combined arms fire and barrier support, requires both a fixing force and a maneuvering force. Infantry heavy forces must perform the fixing function to free tanks for the maneuver elements. These fixing forces will also contain some tanks to perform reconnaissances in force, spoiling attacks, and local counterattacks. The maneuver element, consisting principally of tanks, will also contain some Bradleys to perform reconnaissance, security, clearing, breaching, and suppression missions. The M-113 carrier force can neither fix nor perform the infantry functions required during maneuver because of its inferior firepower and mobility characteristics. The Bradley can perform both roles and perform them well.

The wisdom of the Bradley design has been validated in nineteen high resolution wargames. Fighting as a member of a combined arms task force against overwhelming 3-1 odds (motorized regiment), in a full range of mission and terrain conditions, the Bradley has increased measures of total force effectiveness up to 100% over that of an M-113-equipped force, the precise measure depending on the scenario. Importantly, the Bradley's contribution to the fight was over 200% that of the M-113 in all cases. The Bradley force sustained up to 25% fewer casualties to indirect fire than the M-113 force and reduced total task force personnel casualties by almost 20% in most cases. These increased capabilities allow Bradley forces to fix the enemy, freeing tanks and other Bradleys to seize the initiative through maneuver and shock action—roles that are the basic underpinnings of maneuver warfare doctrine. In short, the Bradley, with its improved firepower and mobility, working synergistically with the remainder of the combined arms force in the execution of a doctrine for which the force was designed, allows that force to win. Without the Bradley, the force frequently loses.

Mr. **Bennett**. The next question I would like to ask is whether or not the decision to remove the fuel and the ammo from the interior of the Bradley preceded or succeeded or followed this particular testing?

General **Thurman**. We have made no specific decisions at the moment on those types of configurations. What we have done is we have taken on board the test. We are looking at some modification of the external armor, and we are looking at some modest restorage of munitions. On fuel we have changed the flow, based upon the test that say empty the top tank first and then——

Mr. **Bennett**. You haven't decided to put them on the outside?

General **Thurman**. We have not decided to put that on the outside at the moment; no, sir. I heard the instruction from Mr. Dickinson, and I conferred with General Wagner, who is my tank expert, and at the moment we have not decided to put them on the outside; no, sir.

Mr. **Bennett**. I see. Well, now the last question I would like to ask.

Wouldn't it be a better procedure for us to have had realistic testing before the purchase of thousands of these vehicles?

General **Thurman**. I think with all due respect, sir, we had realistic testing when we went through it, and I tried to indicate to you the enormous amount of testing that went on. In other words, I just gave you those two vignettes over there, over 200 tests in each one of those little vignettes, and I only selected two out of that whole panoply of checkmarks up there to give you some indication of how much testing goes on.

Now, what has occurred since then is that both the Department of Defense, you and us have agreed that we think we ought to do more testing, although the vehicle met design criteria when it went through the loops getting into production. I think that is a reasonable deal, and that is one reason that I ordered the Department of the Army, after we got the results out of this thing, I ordered the Department of the Army to accelerate by 1 year the M-1A1 tests, because I think we can learn something from it, and we ought to. And will we get blown away in one of those when we get a Soviet round go through?

We may very well. Will it tell us how to improve the interior storage or whatever?

It probably will.

Mr. **Bennett**. Since you said you hadn't decided to put the ammo fuel on the outside what have you to lose and why would you want to keept it inside?

General **Thurman**. You keep ammunition inside for the purpose of having it readily accessible if you want to load weapons which are inside weapons, that is to say the 7.67-millimeter coaxial machinegun or the 23-millimeter cannon is an interior loaded weapon. The TOW is located and loaded externally, so the question is whether or not you hang them on the outside, which increases the width of the vehicle, and gets you in the business of whether you knock them off going through forested areas and the like. So there are some tradeoffs about all of that.

We haven't ruled that out. We are just saying we haven't made any decisions about that.

Mr. **Bennett**. I would have thought there was some say you could have it on the outside in some sort of a door or something to shift to let the things comback in?

General **Thurman**. Might very well do that, maybe block two and half or block three. I have got that under control by General Burba, because I have told him to go down there and look at restowing, as well as protecting. If you can protect it from the outside——

Mr. **Bennett**. Now, the Bradley has never been used in actual combat, has it?

General **Thurman**. It has not, but if you could protect it from the outside you may not have to restow it.

Mr. **Bennett**. Thank you very much.

I have no other further questions.

Mr. **Price**. Mr. McCurdy.

Mr. **McCurdy**. Thank you .

Mr. Battista has some things he would like submitted for the record.

Mr. **Battista**. Yes.

General, would you submit for the record a tradeoff analysis that goes with having the six-man squad versus the nine-man squad that was postulated by the infantry school.

General **Thurman**. Let me clarify that because I will be happy to submit whatever you want for the record. Let me make sure you understand it is a nine-man squad we are talking about.

Mr. **Battista**. I am talking about the element that dismounts to go out and support.

General **Thurman**. The element of dismount is six, with the base of fire as I indicated to you before in the text. There is a maneuver concept here, and the three men in the vehicle perform the base of fire, so it is a nine-man squad.

Mr. **Battista**. If you could submit that for the record though. Basicially, the effectiveness of the dismounted element in accordance with previous studies, and I will give you the time of the group, that was 1814, November 14——

General **Thurman**. I copied it down before.

[The following information was received for the record:]

History of Infantry Squad Organization

Throughout the years, the size of the rifle squad has been a controversial subject. Since 1940, the size of the squad has changed nine times, and has fluctuated from a high of 12 to low of nine.

In its first DRS-associated effort (Division Restructure Study), US Army Infantry School (USAIS) was directed by Training and Doctrine Command (TRADOC) in May-June 1976 to develop an "extreme alternative" 600-man mechanized infantry battalion. Included in the guidance from TRADOC for developing this organization was the directive that the squad would be nine men. This underlying rationale for the TRADOC guidance is embodied in the DRS concept, i.e., smaller but more battalions in the division, higher ratio of leaders to led, significant increases in available firepower for the battalions, and tighter command and control.

On 16 July 1976, the former Chief of Staff, Army, (GEN Weyand) after being briefed on DRS, approved the concepts and endorsed the DRS effort.

Subsequent to receipt of the extreme alternative, HQ TRADOC directed that US Army Infantry Center (USAIC) undertake an evaluation of the nine-man squad, three-vehicle platoon. A later decision on the part of TRADOC restored the fourth vehicle to the platoon. The USAIC evaluation, was, however, conducted with the results forwarded to HQ TRADOC. While that aspect of the evaluation dealing with the number of vehicles was conducted by the US Army Infantry Board (USAIB) in the field, the issues concerning the size of the squad was subjective in nature and accomplished by the Directorate of Combat Developments (DCD). Previous squad studies were reviewed and the Scenario Oriented Recurring Evaluation System (SCORES) process used. The conclusion reached was that the mechanized squad should remain at eleven. It must be noted, however, that the DCD subjective evaluation looked at the mechanized platoon, equipped with M-113's, and in isolation of the rest of the battalion. Clearly, the "combat multipliers" - firepower from the rear envisioned in the DRS concept and the IFV with a Bushmaster weapons system might put a different light on the optimum size of the rifle squad.

In August 1976, DA directed TRADOC to provide the squad size to the DA Mechanized Infantry Combat Vehicle (MICV) Task Force. TRADOC stated the squad size would be nine.

On 27 September 1976, the USAIC submitted its Final Test TOE (TTOE) for the DRS mechanized battalion. The size of the mechanized rifle squad in the TTOE was nine men.

On 5 October 1976, a special briefing on the nine-man squad was given to the Vice Chief of Staff, Army, and on 21 October 1976, to the Chief of Staff. The special squad briefing covered the results of an independent evaluation of the rifle squad conducted by TRADOC. Using a methodology called Weapons Effectiveness Indicators/Weighted United Value (WEI/WUV) the evaluation showed that there was not a significant decrease in firepower effectiveness in the mechanized squad when the size is reduced from 11 to nine. This latter statement is intuitively acceptable when one considers the IFV with Bushmaster and its significant increase in firepower effectiveness over the present M113 with caliber .50 machinegun. In the development of the squad organization, the reduction of two personnel with IFV/Bushmaster is deemed a very logical tradeoff. The firepower of the Bushmaster is substantial. This was corroborated in extensive computer simulations conducted as a part of the Infantry Rifle Study (IRUS) approved by DA in 1971. In its briefing, TRADOC noted that the nine-man squad must be fully manned. This substainability aspect had been a major and continuing point of concern to the USAIC.

Also on 5 October 1976, the MICV Task Force presented an IPR briefing to the Vice Chief of Staff, Army (VCSA) which included TOW Bushmaster Armored Turret (TBAT) implications. The key point at this briefing was that TBAT would drive the squad to nine men. The second MICV Task Force briefing was given at DA on 13 October 1976. Subsequently, the Secretary of the Army approved the development of the TBAT on 30 November 1976. This decision was made after TRADOC's assurance that the DRS nine-man mechanized squad was acceptable. TRADOC's assurance came about by its squad evaluation mentioned above and discussion of the smaller squad with field commands.

Final organization of the Div 86, J-Series mechanized infantry battalion, provided for 4 line companies (vice the previous three companies in the H-Series), with 3 platoons of 3 squads each with 9 squad members. This is a total of 324 squad members led by 36 squad leaders. H-Series battalions provided only 3 maneuver companies with 3 platoons of 3 squads of 11 infantry soldiers. This is a total of 297 infantry squad members led by 27 squad leaders. This Bradley equipped battalion provides both more dismounted infantryman, a more combat effective ratio of leaders to led, with greater firepower support from the Bradley Fighting Vehicle than did the 11 man squad in the M-113 H-Series organization.

The original Div 86 TO&E's reflected the nine man squad for the Bradley Mechanized Battalions. In 1981-82, the Commandant, USAIS (GEN Wetzel) initiated action to restore the 10th man to the Bradley Squad. This action was successful and the July 82 draft J-series TO&E reflected the change. The PM completed necessary contractual actions to have the 10th seat cut into production. In Oct 83, the 10th man was cut from all mechanized squads (BFVS and M-113) in the AOE TO&Es, but the 10th seat was retained in the vehicle.

Mr. BATTISTA. Second, present company excluded, as a private citizen I am most happy and comfortable that you are the Vice Chief of Staff over there, but sometimes I think elements in the

Army tend to wake up in the morning and figure out ways to shoot their toes off in the way they do things.

I refer back to the DIVAD test when we pulled a civilian out of the audience to demonstrate its capability in front of the TV watching Americans.

In the case of the Bradley now, yesterday, I am told by several of the correspondents that the Army in its demonstration or exhibit for the President actually had the Bradleys out in front of the tanks during every occasion.

Can you check into that and find out why a tank particularly like that would have been shown to the media?

General THURMAN. Sure. I wasn't down there so I don't know.

Mr. BATTISTA. Thank you very much .

[The following information was received for the record:]

BRADLEY DEMONSTRATION

During the Bradley media visit, two combined arms maneuver exercises employing the Bradley Fighting Vehicle and the M1 Abrams Tank were conducted. In both exercises, the Task Force Commanders (Company Team Attack) and the Company Commanders (Company Team Defense) fully analyzed the factors of Mission, Enemy, Terrain, Time and Troops Available (METT-T) prior to developing and executing their plans. Based on these factors, they chose to lead initially with tanks. In the company team attack, the commander opted to lead at one point with his dismounted infantry to clear the way for his tanks. Tactics are situation dependent and no particular technique will be used without exception.

The Company Team Attack from which the question stems involved a series of mutually supportive maneuvers orchestrated by a Company Team Commander. The scheme of maneuver took full advantage of the terrain and troops available and reflected the enemy situation. Additionally, the attack made maximum use of all the weapons available to the commander. Close air support, attack helicopters, and direct and indirect fires were in support of the attack. In fact, these weapons rather than IFVs or tanks led the attack from its beginning to its end.

The scenario presented a Battalion Tank Force conducting a movement to contact moving east to west with a Tank Heavy Team (2 Tank platoons, 1 Bradley platoon) leading in the south and a Bradley Heavy Team (2 Bradley platoons, 1 Tank platoon) in the north. The Bradley Heavy Team was observed during this exercise; the tank heavy team was notional.

The terrain in this area (schematic attached) provided some cover and concealment east of Old Georgetown Road. To the west of that road more heavily covered terrain provided excellent dismounted SAGGER and RPG Teams positions for the enemy. It was in this wooded corridor west of the road and just short of the team objective that the commander chose to transport his infantry forward prior to assaulting with his tanks.

Scouts forward of the Battalion Task Force had observed enemy reconnaissance elements dismounted in the wood line at the base of Shell Point, along with T-72 Tanks and BMPs near Williamson Mountain and Bushy Knob. These observations were reported to the TF Commander who ordered the Company Team to execute a hasty attack to clear enemy positions and to seize the gap between Williamson Mountain and Shell Point. The TF Commander called for close air support (A-10s) followed by attack helicopters. MLRS and artillery were also used to soften enemy positions. The effects of these weapons reduced the vulnerability of the Bradleys and M1s in the attack.

The Company Team Commander executed his hasty attack by initially leading with tanks east of Old Georgetown Road. At the same time, under cover and concealment, he maneuvered two Bradley platoons to supporting positions, one in the center and one on the right. The tank platoon crossed Old Georgetown Road in the lead, halted in covered position and directed fire on enemy positions on Williamson Mountain and Bushy Knob. This permitted the two Bradley platoons to move forward. The center Bradley platoon advanced across Old Georgetown Road to clear the woods at the base of Shell Point with dismounted infantry. Enemy SAGGER and RPG teams were cleared from that area.

The northern (far right) Bradley platoon masked by Shell Point, maneuvered into position to support the attack by fire. Both the northern Bradley platoon and the tank platoon provided overwatching direct fire support to the infantry clearing the woods below Shell Point.

With the woods cleared below Shell Point, it remained necessary to sweep the area below Williamson Mountain for enemy infantry. This was necessary in order to initiate the main attack through the gap with the tanks. Under the cover of smoke, artillery, and overwatching fires from the stationary Tank and Bradley platoons, the center Bradley platoon moved across the gap between Shell Point and Williamson Mountain and dismounted its infantry to clear the gap. Once the enemy positions below Williamson Mountain were removed, the tank platoon immediately resumed the lead, shooting on the move. The supporting fires provided by the Bradley platoon atop Shell Point were shifted from Williamson Mountain to enemy positions vicinity Bushy Knob in support of the attacking tanks. The tanks at this point were again leading the attack towards Bushy Knob, the TF Commander's objective. The Bradley platoons were in support from overwatch positions vicinity Williamson Mountain and Shell Point.

Several observations regarding this exercise are appropriate:

The tanks, in fact, were committed first, allowing the Bradley platoons to maneuver to the center and right.

Dismounted infantry were used to clear wooded areas of enemy positions to permit the tanks to pass through a narrow, wooded corridor.

Bradley long-range fire capabilities were used to overwatch the tank platoon and the other Bradley platoon's maneuver.

The tanks, once provided with overwatch by Bradleys, led the attack towards the objective.

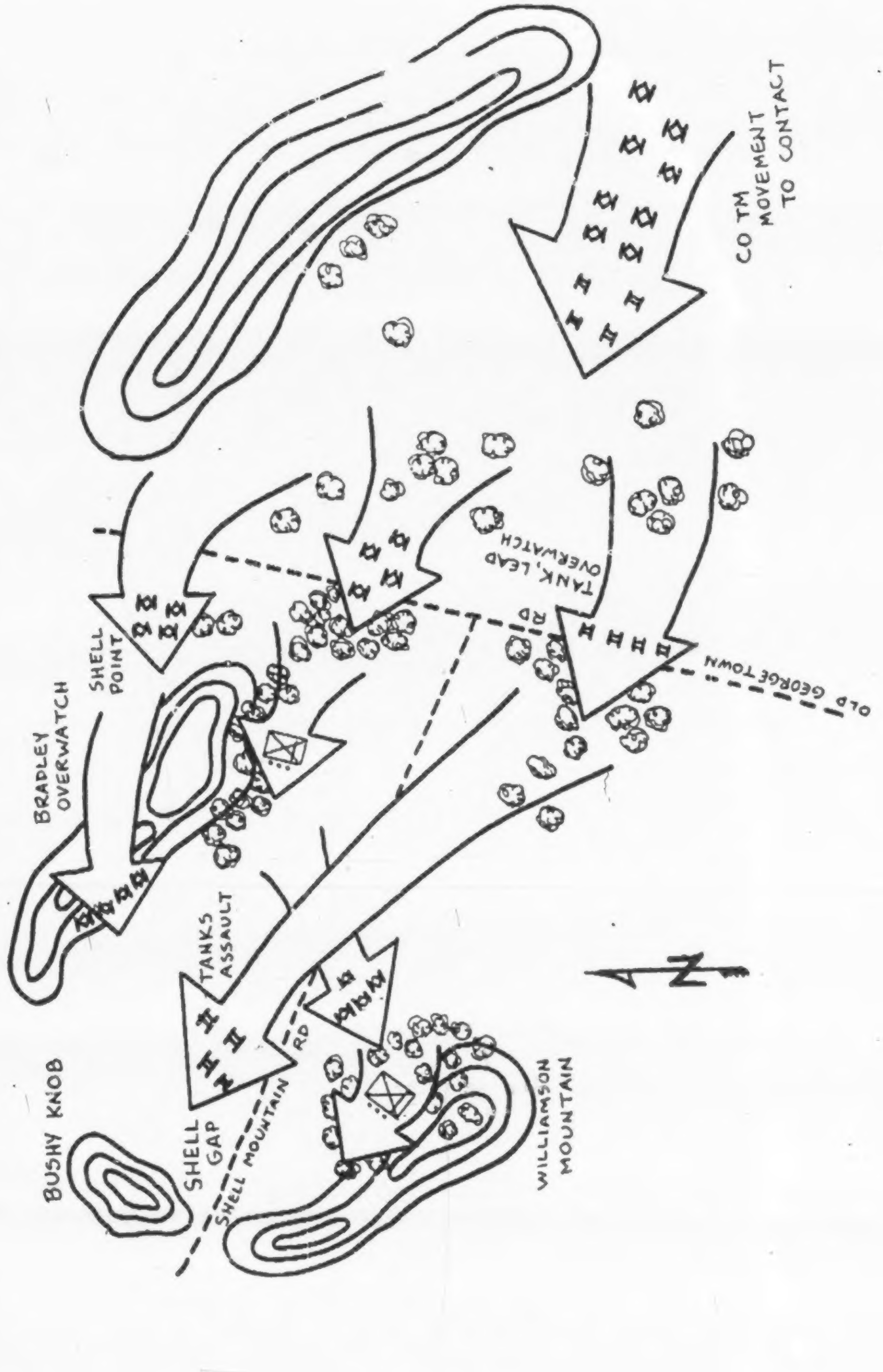
Extensive and powerful fire support (close air support, attack helicopters, MLRS, artillery, smoke, etc) preceded this combined arms attack throughout its duration.

The Bradley and the M1 Abrams worked together as a combined arms team, providing mutual support throughout the attack.

The infantry was moved to its dismount points quickly by the Bradleys, overwatched by tanks and other Bradleys. The vulnerability of the maneuvering Bradley platoon was reduced considerably by the Bradley's speed and by the supporting combined arms effort. Maneuver and/or movement was always under concealment by smoke, and with the enemy being suppressed by direct and indirect fires. In this MILES equipped exercise only one Bradley—a vehicle from the stationary base of fire—was lost.

The Company Team Commander made skillful use of the available cover and concealment, dismounted his infantry when necessary and positioned his Bradleys and Tanks effectively to provide necessary overwatch that exploited the long range fire capabilities of the Bradley and M1. The factors of Mission, Enemy, Terrain, Time and Troops Available governed the employment of the Bradley and M1 throughout the exercise.

COMPANY TEAM ATTACK


CO TM MOVEMENT TO CONTACT
TANK, LEAD OVERWATCH
RD
OLD GEORGETOWN
SHELL POINT
BRADLEY OVERWATCH
TANKS ASSAULT
RD
BUSHY KNOB
SHELL GAP
SHELL MOUNTAIN
WILLIAMSON MOUNTAIN
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Mr. McCurdy. Thank you very much.

We sometimes got a little astray from strictly testing, but I think it was an important hearing. As usual, you do a very good job and we appreciate very much your appearance.

General Thurman. Thank you very much. We appreciate the opportunity.

[Whereupon, at 5:10 p.m., the hearing adjourned.]

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